

COLONIAL REPORTS.—MISCELLANEOUS.

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No. 3.

SIERRA LEONE.

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REPORTS

ON

BOTANY AND GEOLOGY,

BY

G. F. SCOTT ELLIOT, ESQ.,

AND

MISS CATHARINE A. RAISIN.

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Presented to both Houses of Parliament by Command of Her Majesty.  
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### ANNUAL.

| No. | Colony.                            | Year.         |
|-----|------------------------------------|---------------|
| 32  | Lagos - - - - -                    | 1890          |
| 33  | Ceylon - - - - -                   | "             |
| 34  | Newfoundland - - - - -             | "             |
| 35  | Jamaica - - - - -                  | 1889-91       |
| 36  | Victoria - - - - -                 | 1890          |
| 37  | British New Guinea - - - - -       | 1890-91       |
| 38  | St. Vincent - - - - -              | 1891          |
| 39  | Bermuda - - - - -                  | "             |
| 40  | Seychelles and Rodrigues - - - - - | 1889 and 1890 |
| 41  | Gambia - - - - -                   | 1891          |
| 42  | Barbados - - - - -                 | "             |
| 43  | Turks Islands - - - - -            | "             |
| 44  | Bahamas - - - - -                  | "             |
| 45  | Fiji - - - - -                     | 1890          |
| 46  | Seychelles - - - - -               | 1891          |
| 47  | British Bechuanaland - - - - -     | 1890-92       |
| 48  | Malta - - - - -                    | 1890 and 1891 |
| 49  | Gibraltar - - - - -                | 1891          |
| 50  | Falkland - - - - -                 | "             |
| 51  | Leeward Islands - - - - -          | "             |
| 52  | Grenada - - - - -                  | "             |
| 53  | St. Lucia - - - - -                | "             |
| 54  | Labuan - - - - -                   | "             |
| 55  | British Guiana - - - - -           | "             |
| 56  | Zululand - - - - -                 | "             |
| 57  | Mauritius - - - - -                | "             |
| 58  | Lagos - - - - -                    | "             |
| 59  | Straits Settlements - - - - -      | "             |
| 60  | Ceylon - - - - -                   | "             |
| 61  | Natal - - - - -                    | 1891-92       |
| 62  | Basutoland - - - - -               | "             |
| 63  | St. Helena - - - - -               | 1891          |
| 64  | Sierra Leone - - - - -             | "             |
| 65  | Jamaica - - - - -                  | 1891-92       |
| 66  | Trinidad and Tobago - - - - -      | 1891          |
| 67  | Newfoundland - - - - -             | 1891          |

### MISCELLANEOUS.

| No. | Colony.              | Subject.              |
|-----|----------------------|-----------------------|
| 1   | Gold Coast - - - - - | Economic Agriculture. |
| 2   | Zululand - - - - -   | Forests.              |



## INTRODUCTION.

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My object in drawing out the following report has been simply to collect together such information on the subject of native or cultivated plants as seemed to be of practical value. The purely botanical part, will, I hope, afford material for another paper.

I have consulted the following works for the information contained in this paper:—

Moloney.—“Sketch of the Forestry of West Africa.”

Semler.—“Das Tropische Agrikultur,” Bands, 1–4.

Jackson.—“Commercial Botany.”

Christie.—“New Commercial Plants and Drugs.”

“Kew Report” and “Kew Bulletin.”

Dr. Easmon.—“Colonial Reports” No. 1.

Hon. S. Lewis.—“Agricultural Condition of Sierra Leone.”

„ “Annexation.”

Professor Oliver.—“Flora of Tropical Africa,” Vol. 1–3.

Professor Heckel.—“Malunga Ankalaki, etc.”

“Royal Gazette of Sierra Leone,” 1888 to 1891.

I have also done my best to get trustworthy information from all possible sources on the spot. Mr. G. Garrett kindly gave me a valuable collection of dried plants (which I am now working out) as well as much valuable information, and I am also much indebted to the Hon. S. Lewis for many practical hints. I have also to thank Mr. T. S. Buckley, Mr. E. G. Hales, Major Ross, and others for their kind assistance.

This Report has been delayed on account of the time required for identifying the plants concerned. I tried, where possible, to get specimens of every plant of commercial value, and the naming of some 2,000 specimens from a country so insufficiently known as Sierra Leone, has taken a long time.



SIERRA LEONE  
(BOTANY).

I have to express my thanks to Professor Oliver, Mr. Baker, and others at the Kew Herbarium for kindly giving me every possible assistance in this respect. I have also to thank Mr. Morris and Mr. Jackson for some identifications of economic specimens.

The index of native names at the end, may, I hope, be of some service to future workers in the same field. Those in italics are of plants not gathered or seen by me, though occurring on the West Coast. Many of the other names are due to the authorities given above, but most are from my own collection.

The names followed by Med. are of medicinal plants, which are not mentioned here, as Mr. E. M. Holmes has kindly undertaken to work out all of those of which I brought specimens in a separate paper. The "djendjeng," *Dissotis grandiflora*, whose roots contain a large amount of sugar used for making wine is likewise in his care.



REPORT ON THE DISTRICT TRAVERSED BY THE  
ANGLO-FRENCH BOUNDARY COMMISSION.

SIERRA LEONE  
(BOTANY).

BY

G. F. SCOTT ELLIOT, M.A., F.L.S., Botanist.

The country seems to be everywhere underlaid by a gneissose or granitoid rock, which varies greatly in appearance from that of a very coarse red or grey granite to a distinctly foliated gneiss. This rock appears on the sea coast at Sierra Leone, and it also forms the tops of most of the higher plateaux which we saw; thus the Sugarloaf at Sierra Leone consists of a rock of this nature, and it also forms the immensely broad watershed crossed between Falaba and Farana which separates the Scarcies, Rokelle, and Niger drainage areas. This rock, though extremely common and apparently fundamental everywhere, is not often, at least in the lower districts, seen on the surface. Almost the whole of the country lying between the sea level and 2,000 feet, is covered by varieties of a reddish laterite or ironpan, sometimes exceedingly hard and barren, but usually porous, easily worked, and apparently of a very fertile nature. On the top of Mount Kofu I found a thick band of horizontal sandstones, which immediately struck me as being very similar to the so-called Nubian sandstones seen about Wady Halfa, on the Nile; and Miss Raisin agrees with me in this. There is also a very well marked dolerite or basalt flow in the north-west corner of the English sphere of influence, traces of which were found at Wallia and Buyabuya, on the Scarcies River, and which forms a very marked dyke 20 to 30 miles long, on the summit of the hills about Ninia and Duunia in the Talla country. In the immediate neighbourhood of this flow there are some much hardened slates or argillites (the only ones which we saw) and the country is especially fertile where fragments of this dolerite are mingled with gneiss and sandstone.

The dolerite itself is used by the natives as hones for sharpening knives, etc.

An extremely careful and detailed account of about 100 specimens which I brought back will be found annexed (Appendix 1). This has been kindly done for me by Miss C. A. Raisin to whom I am very deeply indebted for her most valuable assistance.



SIERRA LEONE  
(BOTANY).

It will be seen that the only mineral of importance is iron, of which the country appears to contain a very large amount. There is a peculiarly rich belt of titaniferous iron ore in the hills behind Sierra Leone, of which Mr. E. J. Hales kindly gave me a specimen. Messrs. J. H. Collins and Sons, 13 Basinghall Street, E.C., analysed this specimen for me, with the following result:—

|                           | Per cent. |                             |
|---------------------------|-----------|-----------------------------|
| Moisture - - -            | - 1.25    |                             |
| Silicia and silicates - - | - 10.31   |                             |
| Protoperoxide of iron -   | - 70.62   | } 51.91 %<br>Metallic iron. |
| Peroxide of iron - -      | - 1.10    |                             |
| Titanic peroxide - -      | - 14.10   |                             |
| Chromium peroxide - -     | - .15     |                             |
| Manganese peroxide - -    | - .20     |                             |
| Sulphur - - -             | - .03     |                             |
| Phosphorus - - -          | - .04     |                             |
| Lime - - -                | - .02     |                             |
| Oxygen and loss - -       | - 2.18    |                             |

Messrs. Collins further remark that it would be a good iron ore for steelmaking on account of the titanium, but titaniferous iron ore does not produce very largely in the furnace.

Judging from colour and Miss Raisin's remarks on other specimens, there would seem to be a very large amount of iron in the country. It is not at all unusual to find the smelting places of the natives in certain districts. Mr. Hales's deposit might be even worth exporting to this country, but the rest of the iron ore seen is probably too diffused for this to be profitable.

In other respects the country seems destitute of mineral wealth, though, of course, not being a geologist, I cannot speak with any certainty.

Soil.

The soil, so far as we saw, could be roughly grouped into three classes.

*First.*—That of the plateaux and hills about 2,000 feet, or sometimes descending to 1,000 feet, which is due to the disintegration of gneiss or granite rocks.

*Second.*—The red laterite which covers almost invariably all the lower hills from the sea level to 1,000 or 2,000 feet.

*Third.*—The alluvium due either to the action of the mangroves along the coast, or to rivers and streams inland.

Mangroves  
and other  
alluvials.

The effect of the mangroves could be very clearly seen at Mahela and the Samu country generally, and requires a little explanation. The trees seem, in fact, to have been designed by



nature to change any bay or indentation of the coast line into fertile soil. Thus the whole of the country from Mahela to Rokon, and round from Digipali to Kitchom seems to have been at one time a wide bay or arm of the sea, in which sand and mud banks accumulated through the action of the tides and currents. Wherever such a mudbank is in process of formation, the mangroves grow upon it, gradually advancing seawards as the silt accumulates. They require brackish water, and their mode of growth is thoroughly adapted to this habit. The trunk divides at the base into six or seven curved buttress-like roots; each of which subdivides repeatedly so that it covers a wide area, with curved grasping supports. This is, however, but the first stage of growth, after a very short time long hanging roots are sent down vertically from every branch of the tree, and, about the level of high tide, each of these pendant roots divides into five or six grasping fingers, which grow down into the water and root themselves so firmly in the silt that they cannot be torn up by any ordinary force of current. As each branch of every mangrove acts in this way, the soil becomes pierced by roots in every direction, so much so, that where the natives have made a clearance for rice growing, the numerous standing roots in the ground seem like a harrow with the points turned upwards. Hence the leaves of the mangroves and all the silt and soil in the water are held by this meshwork of roots and rootlets, and the accumulation of soil advances rapidly. As the level of the ground (through this accumulation) rises above high tide, the mangroves, which require a constant supply of brackish water, die off and the whole grove advances seaward, leaving behind it a mass of rich vegetable alluvial mud, better suited for rice than probably any other soil in existence. In mapping out the windings of the Mahela creek, we constantly saw how the mangroves were blocking up the channels, and no doubt in course of time the whole creek will become solid land.

Besides these mangroves and other accumulations along the Coast, of which there may be 150 square miles in the Samu country, there are numerous stretches of fine alluvium along the various rivers by which we passed. Thus the plains about Moria, on the upper Scarcies (due probably to the rapids which begin about Wallia), contain, on a rough calculation, some 500 square miles of alluvium. Moreover, there are constantly wide alluvial valleys about Musaia and Falaba, and again by the Niger at Farana. Judging from the size of the many destroyed villages between Falaba and Farana, I calculated this tract must have supported a population of 100,000 people.

The whole of this alluvial ground is well suited for the growth of rice, and probably for that of tobacco, sugar, and cotton as well. That part of it which borders the sea is well adapted for the oil palm, and probably for the cocoanut as well. Taking a



SIERRA LEONE  
(BOTANY).

very low estimate probably 1,000 square miles of the country within our route consists of this kind of soil. The presence of this flat alluvium, covered usually with grasses or marsh plants, makes the valleys about Musaia and Falaba very beautiful.

The windings of every little stream and river through it are marked by a belt of woodland from 50 to 100 yards wide. In the deserted country about Moria and the Niger, these strips of wood are full of green and blue pigeons, as well as other birds, and the grass is full of paths made by the hippopotamus and occasionally by the elephant.

Sandstone and  
grit or laterite.

Most of the remaining country consists of low rolling hills or downs, covered either by almost impenetrably thick bush, about 20 to 30 feet in height, or by tall grasses usually 8 feet and sometimes 10 to 15 feet high. These hills, up to the height of 1,000 feet, consist mainly of the laterite above alluded to. The country was probably originally covered entirely by virgin forest, which has been almost wholly cut down by the natives for cassada clearings. After cultivation for three to five years, such a patch is exhausted and a fresh clearing must be formed.

When a clearing is abandoned the long grasses at once spring up, and, if it is left for 10 or 12 years, the shrubs and climbing plants which form the bush seem to grow up through the grasses and eventually replace them, turning into thick bush which would no doubt eventually become forest, but is in the more densely inhabited parts cut down to form fresh clearings before this happens. Hence travelling through this country is both tedious and difficult. For miles one sees nothing but grass or bush without a break or point of view anywhere, and the paths, only about 2 feet broad, are constantly encumbered by hanging stems of grass or overgrown by branches of trees or shrubs. The extreme density of the bush, however, shows the fertile character of the soil. Usually it takes about half an hour to make one's way 500 yards into the bush, and the grass is almost as difficult and much more tedious.

Almost the whole of this country is well adapted to coffee, cola, &c., as well as the ordinary plants grown by the natives.

So far as we saw there were few cattle anywhere, but the few we did see seemed to be in good health, and the natives always told me that cows did extremely well, but that they were afraid to keep them. The kind of grass which is the most common of all is, according to the natives, eaten by the cattle in its young state, and the disturbed condition of the country is a quite sufficient reason for their absence in most places. I am inclined to think, however, that the low grounds up to 1,000 or 2,000 feet, are not so well adapted for grazing as the higher parts above that level.



*Talla Plateau and Falaba Plateau.*—After one has passed a height of 1,000 feet, the country becomes extremely broken and mountainous for a short distance, and then one finds oneself on a broad plateau, which we estimated to be about 3,600 feet. This plateau is broken by numerous river valleys, and occasionally by domed-shaped hills, of low height. At the North-western corner, or the *Talla Plateau*, there is a considerable amount of dolerite rock, which forms the summit of an isolated table-like part of it, some 30 miles long and 15 broad. On this we found a colony of the Fulas, one of the finest races in the country, who had brought their cattle some hundreds of miles to this part for the dry season, on account of its good and permanent grass. At Erimakuna, also, we were told, some 500 cattle had been in the immediate neighbourhood of the town for the last two months, and every one we saw seemed to be in the very finest possible condition. The same may be said of the horses, donkeys and sheep which we saw; all were in perfect health. In fact these upland plateaux above 2,000 feet, seemed to be marked out as excellent grazing ground. They are usually covered with grass about 2 to 3 feet in height, and very often also by trees as well, but the latter are not so close together as to form a dense bush or forest, but usually 30 to 40 feet apart, and with but little undergrowth. We were in this part of the country just before the beginning of the rains, and there was scarcely any perceptible effect of drought on either trees or grass.

SIERRA LEONE  
(BOTANY).

The whole of the district traversed is abundantly supplied by water. In fact there are large stretches in the lower parts which appear to be always under water in the rainy season, and one can notice everywhere the effect of floods and overflowing of small streams and rivers. The only place in which there seemed to be the slightest scarcity, was on the road from Buyabuya to Moria, on the Kora, and even here the grasses were wet with dew in the early morning.

Water supply  
and rivers.

The first part of our journey lay along the Scarcies river. This is a broad stream, and is navigable by small steamers to within a short distance of Kambia. At Kambia, however, there is a waterfall, three or four feet high, and from this point to about Buyabuya, it is so constantly broken by rapids and dangerous rocks that it is not possible even for canoes to navigate it. From about Wulia, however, it appears to be nearly free of rocks, and could be used by canoes and boats as far as Moria; its tributary at this place (the Kora), and probably also the Lolo river, should be easily navigable for a considerable distance.

If good canoes existed on this upper part to take all produce from the Tamisso and northern countries down to the first rapids on the Scarcies at Buyabuya, it would probably greatly cheapen the cost of carriage. Hippopotami are common in the less frequented parts of the Scarcies and its tributaries.



SIERRA LEONE  
(BOTANY).

The Niger at Farana, and about 5 miles on either side, is about 200 yards in width, and is a sluggish stream of no great depth, and probably easily navigable for a long distance up and down. It is full of hippopotami.

We did not on our return journey follow the course of the Rokelle, but it is said to be navigable by canoes and steamers for a considerable distance inland; no one could, however, tell me exactly how far.

Climate.

The climate of Freetown itself is probably one of the worst in the whole district. This is partly due to the heavy rainfall. Dr. Hart, in the "West African Reporter," gives the following:—

| —                        | 1878.  | 1879.  | 1880.  | 1881.  | 1882.  | 1883.  | 1884. | 1885.  |
|--------------------------|--------|--------|--------|--------|--------|--------|-------|--------|
| Total Rainfall in Inches | 163·14 | 168·11 | 162·06 | 141·82 | 109·29 | 143·15 | 145·9 | 141·78 |

It is also in part due to the enormous amount of trees, which are allowed to remain in the town and on the flanks of the hills which surround it. These trees and the moisture arising from the swampy ground about King Tom, prevent the air from becoming thoroughly dry and render the climate extremely dangerous. The utter want of sanitation and the hard and impervious character of the soil, probably contribute to its unhealthy character. The little village of Regent, in the hills at the back of the town, and many of the villages about Hastings, as well as the Light House, are very much less trying. The barracks at Freetown, which are built on a slight projecting hill, which is kept carefully free of trees, are probably far healthier than any other spot in the neighbourhood.

Speaking generally, any place in the mangrove region, such as Mahela, Kitchom, Robat, &c., will be about as unhealthy as it possibly could be, and no kind of European settlement, whether for trade or plantation, could be recommended. On the other hand, the climate of the lower hills and the high plateau are, as compared with the mangrove parts, fairly good. If a European builds his house on a spot far removed from marshy ground, or places liable to be flooded, with a wide area clear of trees and shrubs all round it, and if he can choose a soil which water freely passes through, he should be fairly healthy, provided, of course, drainage and water are attended to.

It might almost be possible to establish European colonists on the high plateau of Farana and Falaba, but my own personal experience, which was confirmed by that of others, was that even there any exertion was exhausting in the extreme, and most of us



had attacks of fever even on those high and comparatively healthy plateaux. SIERRA LEONE  
(BOTANY).

Therefore it seems unlikely that European settlers could colonize the country without great loss of life. On the other hand, the climate (excluding Freetown and the mangrove districts), is very probably not worse than that of India, provided the above conditions are attended to, and, though dangerous, would not prevent plantations of coffee or cattle raising. The great difficulty is its extreme humidity; even in the end of the dry season the dews are so heavy that, until about 9 a.m., the grass and shrubs are as wet as possible. The sun is extremely hot from about 11 a.m. to 4 p.m., and no exertion should be undertaken during these hours if it can possibly be avoided. Immediately after sunset the air rapidly cools and the dews begin to fall. The few observations which were taken by me during part of the journey showed a range of temperature from a mean of some  $95^{\circ}$  to  $102^{\circ}$ , and  $89^{\circ}$  from 25th February to 27th March.

These were all maximum observations and made about 4 to 6 p.m., by hanging the thermometer under the thatched verandah of the hut where I was. The manner in which the tornadoes often, after a day or half a day's interval, greatly lowered the temperature was remarkable, and it will be seen that the heat experienced was not very great.

The natives frequently set fire to these grass-covered lands before the rains, and such fires will run an enormous distance before stopping. The wood belts by rivers, which are always full of moisture, seem to very often stop such a fire. Sometimes a native village is caught by one and is then usually burnt to the ground. This happened to a village in which we were, but it was fortunately checked in time.

There appear to be two main highways into the interior at present. The first is the route by which we returned, and passes from Falaba through Kabusa, Kahréni, Bentembu, &c., to Port Lokko. This road is extremely good and easy to travel as far as Kahréni, and lies on alluvium and low laterite hills (Kahréni is probably some 700 feet in altitude); it is, however, liable to inundation in the rainy season and is practically almost impassible at that time. From Kahréni until a day's journey from Falaba, the road is almost as bad as it possibly could be, sometimes going through difficult or dangerous swamps, sometimes passing through dense virgin forest or climbing steep mountain chains covered with fallen blocks and stones.

Another road passes from Port Lokko diagonally across the country, roughly speaking, to the Talla country, and the junction of the Kora and Scarcies river. The Susu Limba wars had stopped traffic on this road during part of our journey. Its



SIERRA LEONE  
(BOTANY).

termination at the Talla river plain is probably not more than 1,000 feet above the sea, and the road probably avoids most of the broken mountainous country; it has one or two strong rivers to cross *en route*, but still it is in all probability the easiest of all the ways to the interior, and is nearly in a straight line with the rich Fula country. A third route passes up the Scarcies from Kambia to Kukuna, Buyabuya, &c., and is fairly easy to travel, but is neither so good as the Lokko portion of the Falaba road nor so difficult as the part beyond Kahréni.

The roads were during our journey so much disturbed by native wars and troubles, that no traffic was coming in that direction. On the other side of our journey, it seems a pity that the Rokelle should not be navigated as far as is possible for canoes; a direct main road to Koronko and the country beyond the Niger might be easily made from this point on the Rokelle, which might be taken in such a course as to get at once on the Falaba plateau and avoid the difficult country above Kahréni. Such a road would be a far shorter way to the interior than the present one, and avoid the present journey to Port Lokko and Suma's country.

Native  
villages.

The villages we saw were all very much of the same pattern. The houses are almost always built of mud, which in this climate rapidly hardens into a brick. They are all thatched with grass, supported by rafters, often made of the stalks of the bamboo palm. A sort of verandah is made outside the wall of the house by the roof being made to project 3 or 4 feet beyond the inside wall. The houses are almost circular in shape; those about Kambia and Kukuna are a fair size, sometimes 30 feet in diameter with the wall 10 feet high, and are both cool and clean. The floor and the inside of the wall is often coated with a mixture of earth and cow-dung, which is smoothed or varnished by the juice from the stem of the Yetté *Ophiocaulon cissampeloides*. Many of the villages are without any protecting fence, particularly if the people are poor and industrious. The robber villages about Tassin and Laya are protected by mud walls loop-holed in various directions and sometimes 8 feet in height, usually each house is surrounded by a wall of this kind and the entrance is by a small circular turret with two gates and numerous loopholes which stands out from the line of wall so as to defend the path leading to it. Such mud walls are common in the Samu, Digsinn, Benna, Tambakka, and Timmenie countries.

Higher up in the interior, villages are often protected by hedges of thorny accacias which are made to form a dense bush some 40 yards in width all round the town. In the Falaba and Limba districts the towns are often surrounded by one to three circular stockades of vertical branches, and the gates are made of wood and very strong. Certain towns like Bafodeya are



placed in such a position that they are almost impossible to enter except by a long narrow path exposed to fire from the town itself. I have once or twice noticed that the path to the town is a deep narrow trench cut into the ground and commanded by loop-holes; this is the favourite defence in Madagascar.

SIERRA LEONE  
(BOTANY).

Any of these towns would be difficult to take *if* held resolutely, but, as a rule, all the inhabitants fly to the bush when an attack is made.

The districts near Port Lokko and part of the Samu country are densely populated. Villages of small size occur every three or four miles, and a fair proportion, perhaps a tenth part, of the ground is under cultivation. The constant fighting has nearly destroyed the population in all the northern part of the country from Sikuru to Falaba and Farana, and the villages are 14 to 20 miles apart, and inhabited by very few people. The intermediate part, including most of Tambakka and Limba, contains a fair number of villages, but only an insignificant part is under cultivation. The American missionaries say that it is very difficult to obtain land, and probably most of the country in Limba and Tambakka is claimed by certain families. There are, however, so many villages absolutely waste, and so much of the country has been denuded of its inhabitants, that probably many thousands of acres are not even claimed by anyone, and are open to anyone who cares to take possession.

Population.

Each native village is practically self-supporting, and requires next to no commerce with the outside world. They grow, weave, and dye their own cloth. They drink wine from their own palms and all their food is, as a rule, grown by each village for itself. They do, however, appreciate certain European articles, various kinds of cloth, beads, fancy articles, china, &c., and guns and gunpowder meet with a ready sale everywhere; a large amount of tobacco is also imported though it could be grown on the spot. The young men, however, in the more law-abiding places are always ready to work in order to obtain wives and slaves. In most of the country there has been so much war that those of the young men who are ambitious and energetic take to slave-trading, and those who are not, for the most part are soon killed or enslaved. In fact, the amount of trade possible if the country were settled cannot be estimated from that which exists at present. The Hon. S. Lewis, in a paper on "Annexation," read before the Sierra Leone Association in 1885, brings out the influence of native wars in a very clear manner.

Trade and  
commerce.

"After the Kwia war of 1861 the cultivation of all produce brought from or through the Sierra Leone river gradually increased till 1874. From 1874 downwards the fall in the quantities has been very marked." He shows that this is due to the wars and disorder in the Yonni country, which are not



SIERRA LEONE even yet settled definitely, and the following table taken from  
(BOTANY). his paper illustrates the effect on commerce :—

|                                          | Exports from Sierra Leone River in the Years |         |                |
|------------------------------------------|----------------------------------------------|---------|----------------|
|                                          | 1874.                                        | 1880.   | 1885.          |
| Ground nut, bushels -                    | 687,000                                      | 72,000  | 1,000          |
| Palm kernels „ -                         | 73,000                                       | 37,000  | 3,500          |
| Beniseed, bushels -                      | 25,000                                       | 8,000   | 2,800          |
| Purchasing power at prices<br>that year. | £85,000                                      | £13,000 | Insignificant. |

Thus, these troubles between two insignificant native tribes which might have been put down immediately at a cost of 10,000*l.*, produced an annual loss of about 84,000*l.* export trade, involving probably an annual loss to the Customs of 16,000*l.*, and the land having by this time reverted entirely to the original bush and the population having been reduced by something like 90 per cent., at least 30 years must elapse after peace and security have been restored before the same amount of trade can be re-established. The present export trade of Sierra Leone is considerable; in 1890 it amounted to nearly 237,000*l.* (“Gazette,” February 1891) of which 147,000*l.* came to Great Britain, 50,000 to France, 26,000*l.* to Germany, and the remainder chiefly to various places on the coast or to unknown ports.

Fortunately most of the export consists of palm oil and kernels, of which the value in 1890 amounted to 121,000*l.* nearly, and this is derived chiefly from the Coast ports, and is not, therefore, so much affected by native wars. With this exception, however, it may confidently be expected that the longer native wars are allowed to continue and increase (as such disturbances always do increase), the more injurious will be the effect on the export trade and the less purchasing value will remain in native hands. On the other hand, the amount, 84,000*l.*, exported from so small an area as that affected by the Yonnie wars show what would be possible in the way of export provided every native knew that he had a fair chance of getting some kind of return for his labour.

Conclusion.  
Value of  
district.

Geologically the country is poor, but consists almost entirely of good and fertile soil; it possesses in minerals only a certain amount of iron. From a botanical point of view it is probably much more suited to most valuable tropical plants than either Jamaica or Mauritius, *but* the climate is in most parts dangerous for Europeans, and neither energy nor physique can be kept up sufficiently to make proper use of its natural advantages. It will be seen from the following that in the route we followed both forests and probably rubber are being rapidly exhausted; on the



other hand, cultivation of oilseeds and other plants will probably advance with and make up for the loss of timber and rubber; it will also be seen from what follows that the list of valuable fibre, oil-yielding and edible plants is extraordinarily long, and that there are numerous plants such as coffee, ginger, &c., of which the cultivation can be indefinitely extended and which are extremely profitable.

SIERRA LEONE  
(BOTANY).

The colony at present has a valuable trade. (The figures are taken from the "Sierra Leone Gazette.") The exports in 1890 were worth 236,600*l.*, of which 147,000*l.* went to Great Britain, but since 1888 they have been diminishing.

| —               | 1885.  | 1886.  | 1887.  | 1888.   | 1889.   | 1890.   |
|-----------------|--------|--------|--------|---------|---------|---------|
| Export values - | 53,847 | 69,754 | 79,597 | 242,818 | 223,508 | 236,638 |

#### COFFEE.

Coffee was discovered wild at Sierra Leone so long ago as 1796 by Mr. A. Moore. At present there are two different species cultivated by the natives and these require different treatment.

*Coffea Stenophylla*.—The narrow-leaved "wild," "bush," or "native coffee" is sometimes found wild in the hills, and is more often cultivated by the natives than the Liberian. It grows very freely and appears to yield quite as much as the Liberian, but it is somewhat longer in coming into bearing. Both the natives and French traders at Freetown say that it has a superior flavour, and prefer it to the Liberian. In fact, latterly, a certain amount has been exported to a wholesale French dealer, who is said to sell it at 4 francs 50 centimes a lb. as "best Mocha"; considering that it is worth in Freetown about 6*d.* a lb. this should be a fairly profitable trade, and a trial shipment should be made by the English merchants to find out exactly what the market value in Liverpool would be. The plant appears to thrive best on the higher hills about Sierra Leone on gneissose or granitic soil, and can be grown from 500 to 2,000 feet; probably it may be grown both above and below these limits.

*Coffea Liberica*.—There is no doubt that the cultivation of this coffee is extremely profitable in the Sierra Leone district. There is one well established plantation, and bushes may be constantly seen in native enclosures. The Hon. S. Lewis was kind enough to show me over his plantation at Christiansville, which probably contains some 70,000 trees, and gave me every information with regard to it. It was commenced in 1883, and of course was in its initial stages both extremely expensive and



SIERRA LEONE (BOTANY). disappointing. Now, however, Mr. Lewis thinks he has advanced beyond the experimental stage, and he certainly seems to be gaining the reward which his enterprise and perseverance so well deserve.

*Soil.*—The result of his experience shows that the reddish grit or ironpan, which is the most common of all soils in the colony, is well adapted to Liberian coffee. Some of his plants on this ground began to yield when only three years old, and one of them gave last year about 138 lbs. of berry.

Lately, Mr. Lewis has been planting vigorously on the higher grounds composed of gneiss and granite; these are too young as yet for any positive conclusions to be drawn, but certainly the plants could not appear more healthy and vigorous than they are at present.

On the other hand, his experience of low-lying sandy alluvial ground is unfavourable, mainly on account of its becoming too dry in the hot season. This difficulty may be, however, overcome by irrigation or planting shade trees such as Kola amongst the lines.

On the red grit, however, he finds that an average of 7s. per tree may be expected, and he calculates a profit of 6d. a tree after paying all expenses.

His plants are at 12 feet distances, and gaps in the lines are very few; in fact the absence of fungus and insect diseases is very remarkable throughout the plantation. Labour is required chiefly for keeping down the undergrowth and for picking and preparation; Mr. Lewis pays 8s. to 10s. a month, but a European could not expect to get efficient labour so cheaply; the Government pay 8d. to 1s. a day at Freetown.

Hence, it seems probable that a European could expect to make a considerable profit in growing coffee, especially as land is said to be obtainable at 4s. per acre freehold. A small capital (say 1,000l.) would be required, and the beginning might be made in a very economical manner by spending the first year in formation of coffee nurseries and planting cassada and ginger, for which only three labourers would be required; during the second year the ground for coffee should be cleared and planted, and the ginger and cassada would yield a small profit; in the third year further extension of the plantation and cassada could be made, and in the fourth year the coffee would begin to produce.

The cassada growing alluded to can be made more profitable by feeding pigs on the roots; these increase so fast as to be a very profitable investment in themselves, and the manure is a great assistance to the coffee. Care should be taken, however, that neither cassada nor ginger should be planted on ground afterwards intended for coffee as both are very exhausting crops.



Speaking generally, however, a yield of 7s. per tree scarcely seems to be sufficient to recoup a European for a long residence in a climate so trying to the constitution as Sierra Leone, and the future of the coffee trade probably rests in the hands of the natives.

SIERRA LEONE  
(BOTANY).

There should be room at present at Sierra Leone for the cheap machines used in Ceylon and America for pulping, shelling, and removing the silverskin. Information as to these machines may be found in Semler, "Das Tropische Agrikultur," Band 1. The pulper consists of an iron cylinder covered with teeth which is made to revolve and passes close to an iron sheet down which the berries are brought in a stream of water. The pulp is used as manure. Peeling or shelling is sometimes performed in a circular or cylindrical tank; in this there is a circular groove round which two wheels, attached to a horizontal axis fastened in the centre to a vertical post, are made to revolve. A simple hand-turned machine would, however, be probably of more practical use at Sierra Leone, such as "the American coffee-sheller," cited in the above-mentioned work. Machines for removing the silverskin, winnowing, and sorting, are also in existence.

The production of coffee on the West Coast is said to amount to 14,500 tons, of which only 4,500 are exported, and to occupy 100,000 acres. It is said to bring about 47s. to 70s. per cwt. in Liverpool, but this information is probably only approximate.

As stated above the amount of soil suited for its cultivation in the district we traversed is enormous, probably nearly half the total area.

*Kéré, Cassia occidentalis*.—The seeds are sometimes used as a coffee substitute, and both leaves and seeds as a febrifuge. I found this plant in the Samu country, No. 4295, and also received it from Mr. Garrett, Sherboro, No. 5786.

#### COCOA.

*Theobroma Cacao*.—The plant is one which prefers a warm wet climate and would seem well suited to Sierra Leone. Such trees as I have seen at Mr. Vohsen's farm and at Christiansville seemed in a very healthy condition, but Mr. Lewis and others do not speak favourably as to its prospects. Probably this is due to the difficulty in preparation, and a misunderstanding as to the conditions which the plant requires. When wild, it is found growing in deep narrow valleys, and either fully or half shaded. It should be both well protected from the wind and sun, and also planted either by rivers or in places where neither the air nor the soil is allowed to become very dry. Thus, in Sierra Leone it would probably do well in the woods fringing rivers or streams, or in small clearings 10 feet in diameter in the original bush. (See Pepper, &c.)

The plant begins to bear at from the third to the seventh year, and is probably in full bearing after eight years.



SIERRA LEONE  
(BOTANY).

Mr. Christie (*New Commercial Plants*, No. 7, p. 12) gives the following hints as to preparation. Gather when ripe, then leave the beans in heaps to "sweat"; then wash the beans carefully as soon as the mucilage which exudes from them is sufficiently decayed for this to be readily done; care must be taken, however, that the cotyledons or seed leaves are not unfolded; then dry the beans in the sun. The object is to obtain a good red colour.

Another method consists in splitting off the husks at once and leaving the beans in a fermenting cistern five to nine days.

An attempt has been made to cultivate Cocoa at the Gold Coast (*vide* Dr. Easmon, *Colonial Report*, No. 1) where there are 300 to 400 trees two to four years old, of which the larger bear 50 healthy pods. Dr. Easmon says it should be planted on rich, dark, and well-drained soil.

So much care is required that, in spite of its value, cocoa is scarcely likely to pay at Sierra Leone. It is, however, worth trying, as even the husks are worth 5*l.* to 6*l.* a ton as a cattle food.

#### KOLA.

*Kola Acuminata*.—The tree grows freely everywhere, and we found it from the sea level to fully 3,000 feet at Sumbaraya in the Talla highlands. It appears to thrive wherever planted, and is well able to hold its own in the original native bush. I could not find any special conditions of soil as necessary, but it certainly grows on disintegrated gneiss, red grit or laterite, dolerite, and occasionally on dry alluvium. I do not think I ever saw it on marshy ground or soil liable to be overflowed, and such places ought to be avoided.

It begins to bear in seven years, and is in full bearing after eight to 10 years. Each tree is said to yield 3*l.* to 4*l.* per annum, and hence a plantation ought certainly to include a large number of these trees. The yield given by Mr. Fawcett is 125 lbs., or 4,000 seeds per tree, that is 8*l.* to 10*l.* per tree, or 800*l.* an acre. Semler, l.c., p. 200, says it produces 50 kilog. in the 10th year.

At present the nuts are chiefly used by the natives, but Messrs. Christie and others have done so much of late years to bring its valuable properties before the public that it may be safely said that the demand in Europe is sure to increase.

The following are some of its properties. A nut, or even half a nut, will enable one to go without food and support great fatigue for 24 hours or more. It is an excellent nerve tonic, and is specially good for keeping the brain clear and active at night; it, however, prevents sleep almost too thoroughly, and should not be taken less than four hours before bed. A property not understood is that of rapidly clearing foul water and improving beer. It is said to remove immediately and thoroughly the unsteadiness and stupidity due to drunkenness.



The following is the latest and most careful analysis I have seen. Semler, *Tropische Agrikultur*, 1892, p. 200 :—

SIERRA LEONE  
(BOTANY).

|                                          | Per cent. | Per cent. |
|------------------------------------------|-----------|-----------|
| Thein - - - - -                          | 2·710     |           |
| Theobromin - - - - -                     | 0·084     |           |
| Bitter principle - - - - -               | 0·018     |           |
| Alkaloids, Total - - - - -               |           | 2·812     |
| Fatty oils - - - - -                     | 0·734     |           |
| Ethereal oil - - - - -                   | 0·081     |           |
| Total - - - - -                          |           | 0·815     |
| Sugar - - - - -                          |           | 3·914     |
| Gum - - - - -                            |           | 4·876     |
| Starch - - - - -                         |           | 28·990    |
| Amides - - - - -                         |           | 2·130     |
| Albumen - - - - -                        |           | 8·642     |
| Red and other colouring matter - - - - - |           | 3·670     |
| “Kolagerbsaure” ( <i>sic</i> ) - - - - - |           | 1·204     |
| Water - - - - -                          |           | 9·722     |
| “Rohfaser” and Loss - - - - -            |           | 27·395    |
| Potash - - - - -                         | 1·415     |           |
| Chlorine - - - - -                       | 0·702     |           |
| Phosphoric acid - - - - -                | 0·371     |           |
| Other salts - - - - -                    | 2·330     |           |
| Total Ash - - - - -                      |           | 4·818     |

#### OTHER SPICES.

*Cubebs. Piper Clusii.*—Grows freely at Sierra Leone; its seeds are worth some 20*l.* per cwt.

*Black Pepper. Piper nigrum.*—In 1888, 770 cwt. of black pepper are said to have been exported from Sierra Leone. The plant is a climber which requires a wet atmosphere, a wet though not marshy soil, and a certain amount of shade. It is, therefore, exactly suited to the bush covered country about Sierra Leone, and should be planted at the foot of trees in the natural bush. A heap of dead leaves should be placed round the support, and if the place is liable to get dry, a small bank of earth to retain water should surround the seedling. The seed should be soaked in water and the skin removed before planting. This plant might also be tried at the foot of Kola, coffee, and cocoa trees.

*Vanilla.*—Requires almost exactly the same treatment as black pepper. The plant does grow at Sierra Leone (*vide* the Hon. S. Lewis), and probably would yield a profit. The root of the climber should be covered with stones and manured. It begins to bear in the third year, and lasts 20 years; fertilisation of



SIERRA LEONE the flowers is necessary, but is a very simple matter. It produces  
(BOTANY). sometimes 27 kilos per hectare, and is worth from 1*l.* to 25*s.*  
a lb.

*Gambier. Uncaria Gambier.*—Would seem to thrive under similar conditions to those found at Sierra Leone. It should be planted out in the natural bush, as suggested for black pepper. Eight labourers are said to be able to collect 70 to 75 lbs. daily from 100,000 plants. No attempt has been made to grow it at Sierra Leone so far as I know.

*Ginger Zingiber officinale.*—The cultivation of this plant is even now profitably carried on at Sierra Leone, and the obstacle to its further development appears to be simply the dirty and careless way in which it is prepared for market. The plant produces abundantly in nine to ten months after plantation, and the quality is excellent and better than that of Jamaica-grown ginger.

The export trade is shown by the following figures; those to 1880 derived from the Hon. S. Lewis, and the rest from the Royal Gazette.

| —               | 1842.      | 1846.       | 1866.       | 1877.       | 1880.       | 1888.      | 1889.      | 1890.      |
|-----------------|------------|-------------|-------------|-------------|-------------|------------|------------|------------|
| Value of Export | £<br>1,599 | £<br>14,631 | £<br>24,740 | £<br>19,309 | £<br>10,113 | £<br>8,516 | £<br>6,382 | £<br>4,635 |

Careful washing and abstinence from adulterating the product would probably soon bring the figures back to those shown for 1866; Mr. Lewis says that a man can make 30*l.* to 40*l.* a year on two acres without capital or special tools by this plant.

*Cardamoms. Amomum cardamomum.*—The plant would almost certainly thrive at Sierra Leone. It bears in the third or fourth year, and yields 1,000 lbs. of seed per hectare. (Semler, l c.)

*Malaguetta pepper, Grains of Paradise. Amomum Malaguetta, grana-paradisiaca.*—This is wild at Sierra Leone, and was at one time largely exported; the seeds seem, however, to be no longer in demand.

*Sugar cane. Saccharum officinale.*—The sugar cane is cultivated at Hastings and one or two other places near Sierra Leone, and, so far as I have seen, seems to be suited to the climate. It is, however, not probable that a profit can be drawn from its cultivation at Sierra Leone, as complicated machinery and a great deal of skill is required to make it pay. The country best suited for it would be probably the alluvial ground not adapted for coffee or other plants. I find from the Gazette that the value of the sugar imported at Sierra Leone was in 1888, 2,650*l.*; in 1889, 3,655*l.*; in 1890, 3,534*l.*, all of which could be easily produced on the spot. Large quantities were produced by Mr. Pindar Hart at Bendu, but he died before his plantation came into full bearing.



*Tobacco. Nicotiana tabacum.*—Almost the same remarks apply to tobacco which is pretty often grown by the natives in some districts. A little was grown at Falaba, on the Niger, and appeared to do well on the rich alluvium about the rivers. Mr. Aldridge found a considerable amount cultivated in the Mendi district. It would certainly be an easy matter to grow a rough cheap tobacco suited to native requirements, and thus do away with the enormous present import trade. The Gazette gives the following figures as the value of the unmanufactured tobacco imported:—In 1888, 15,219*l.*; in 1889, 17,114*l.*; in 1890, 16,623*l.* It ought to be dried in the shade in well ventilated houses, through which a current of hot air is made to pass.

SIERRA LEONE  
(BOTANY).

*Cinnamom, Laurus cinnamomum or Cinnamomum Zeylanicum.*—This plant was one of those tried at the unfortunate Clarkson plantation, begun in 1792, and which, having been exposed to the tender mercies of a retired seaman, a stone blaster, and a native chief, was abandoned in 1801. The plant, however, grew well, and produced fruit freely in five years, and it is also said to have grown luxuriantly at Heddle's Farm. It is a plant preferring woods on a rocky soil and plenty of moisture, and is usually grown at from 3 to 7,000 feet.

*Nutmeg. Myristica moschata.*—Is also said to have grown well at Heddle's Farm, but it requires 8 to 15 years to come into full bearing, and even in Ceylon does not seem to have been a success. The natural conditions are eminently suited to it.

*Mutugo Nutmeg or Combo. Myristica angolensis.*—Yields 72 per cent. of its weight in fatty oil; they are sometimes imported to Liverpool, and may be of use.

*Pimenta. Eugenia pimenta.*—This might also be tried at Sierra Leone.

*Arrowroot. Maranta arundinacea.*—This plant grows exceedingly well in West Africa, and apparently in any soil. It does not require any cultivation, and that grown in Sierra Leone appears to be the best in the world. Unfortunately, however, the market has been spoilt, simply because the natives would adulterate the flour with cassada, and would not clean it properly.

Formerly it formed a part of the export trade of Sierra Leone. Thus, in 1842, 21,650 lbs., value 403*l.*, and in 1846, 82,486 lbs., value 1,201*l.*, were exported. The difficulty is to prepare the arrowroot in a clean and marketable manner. Semler, l. c., gives the following hints:—The roots are first washed in running water; then the outside rind containing a bitter principle, is peeled off; the product is again thoroughly washed, and then reduced to powder by crushing in a mill; the fibres existing in the powder are separated from the starch by being passed with a current of water through a cylinder of tinned copper in which another toothed cylinder is made to revolve. The milk thus obtained is left to allow the starch to settle, and the water is poured off. It is then dried in shallow pans covered with gauze to keep off insects.



SIERRA LEONE  
(BOTANY).

### OIL YIELDING PLANTS.

*Oil palm. Eleæis guineensis.*—The export of palm oil and kernels forms by far the largest part of the West African Export Trade. The following figures are given by the Sierra Leone Gazette :—

| —                    | 1888.  | 1889.   | 1890.   |
|----------------------|--------|---------|---------|
|                      | £      | £       | £       |
| Palm oil - - - -     | 12,285 | 11,379  | 13,599  |
| Palm kernels - - - - | 97,177 | 105,963 | 107,827 |

The tree is more abundant further down the West African coast, and appears to prefer alluvial, often marshy, ground near the sea. It particularly seems to thrive on the rich soil of the mangrove accumulations. There are large numbers of these trees in the Mahela district, where a factory once existed, and there are also a considerable number up the Scarcies river, and in the lower part of the Limba district. It grows also on low sandstone or gneissose hills, but probably does not produce so much in such places as on the low lying rich alluvials. The palm is propagated from the offshoots that appear at its base, and these are said to begin to bear in the second or fifth year, and are in full bearing about the 10th to 15th year; they continue producing for 60 years.

A single tree yields from 1 to 3 gallons of palm oil or, according to Semler (l.c.), 16 litres annually, and this amount of oil will give from  $\frac{1}{6}$ th to half a hundred weight of kernels. This would be a profit of from 2s. to 6s. a tree per annum, as about 300 gallons of palm oil give a ton of oil, and about  $2\frac{1}{2}$  tons of kernels. Hence plantations of these trees should be profitable in time. It is, however, exceedingly difficult to get any trustworthy information, and the above must be regarded as very approximate. The palms require no care, and are not, apparently, attacked by any injurious insects.

The preparation is of a very rough and makeshift character; the fruits are thrown into a tank and left till decomposition begins; they are then boiled, and afterwards pounded in a mortar; probably 25 per cent. of the oil is lost in preparation.

*Groundnut. Arachis hypogea.*—A considerable export of groundnuts takes place from the West coast. At present the supply seems to be falling off at Sierra Leone, and the value of the export for 1890 is given in the Royal Gazette as only 664*l*. It was not frequently seen in the district we passed, although it is very abundant in the Gambia river, in the low lying country about Mahela and Kitchom; and I again saw it on the Scarcies tributaries, about 10° N. latitude, and near Falab. It seems to be usually cultivated on rich alluvium; all the grass and shrubs have to be carefully rooted up and burnt before the nuts are



planted. The yield is said to be enormous, but it is probably a very exhausting crop. The kernels contain 50 to 55 per cent. of oil. SIERRA LEONE  
(BOTANY).

*Sesame, Black Beniseed, Gingelly, Sesamum indicum.*—This plant is a small herb, some 18 inches high, and is pretty often cultivated both in the Samu and Limba countries, and also occasionally on the higher plateaux of Falaba and the Niger. It produces a crop in three or four months time after sowing. The seeds yield an oil, and are constantly imported into Liverpool. The plant might be cultivated almost anywhere in the district provided the price for export rendered it profitable. The total export to Europe is said to be 260 millions of kilos. (Semler l.c.)

*White Beniseed. Maluku, Ankalaki, Polygala Butyracea Heckel (very near Polygala rarifolia).*—We found this plant frequently cultivated in the Samu country and near Kambia. It is about 6 feet in height, and appears to prefer the gneissose or ironpan hills of low altitude. In other respects it is very similar to the preceding. The yield, however, is probably low as compared with *Sesamum*, as each plant occupies a considerable space. The seeds yield about 17·55 per cent. of fatty matter, and may be used for margarine. Professor Heckel gives the following analysis:—

|               |   |   |   |                |
|---------------|---|---|---|----------------|
| Oleine        | - | - | - | 31·5 per cent. |
| Palmitic acid | - | - | - | 4·8 „          |
| Palmitine     | - | - | - | 57·5 „         |
| Myrotine      | - | - | - | 6·16 „         |

The following oil-yielding plants are of less importance, but are all worth investigation.

*Agusi, Ogousi, Cucumis sp.*, on the authority of Mr. Morris.—It seems to be one of the species usually called *Cucumis melo*.

This is often sold in the Freetown markets, and is one of the constituents of the far-famed palaver sauce. It has a certain commercial importance, for in 1882 about 1,390*l.* in value was exported, and brought about 1*l.* per kilo. If it is *Cucumis melo*, the cultivation should be capable of indefinite extension.

*Bonduc, Guarri. Cæsalpinia Bonducelli.*—The seeds yield an oil, and are occasionally used as a tonic, but the yield would probably be rather too low to repay cultivation.

*Brassica juncea.*—This common weed could be easily grown at Sierra Leone, and yields an oil which has not been properly tried.

*Bambarra, Voandzeia subterranea.*—Occasionally cultivated, but probably replaced by the groundnut.

*Crab. Carapa guyanensis.*—This is a common tree in the districts which we passed. I found it at George Water, near Freetown, No. 4,153, and again in the Talla hills, No. 4,813. The fruits yield 36 per cent. of their weight in oil, and the kernels 60 per cent.



SIERRA LEONE  
(BOTANY).

*Cashewnut. Anacardium occidentale.*—This is very commonly planted about Freetown, and also in some of the small villages up the Scarcies river to about 500 feet altitude. The kernels contain a clear edible oil (something like olive oil) in the proportion of 40 to 50 per cent. of their weight. The nuts are exported to Germany, where they are used for cooking and chocolate manufacture. According to the Hon. S. Lewis, they are worth 9s. a hundredweight, and if this price is correct they would certainly repay collection, and probably cultivation, at Sierra Leone.

*Cotton Seed. Gossypium barbadense.*—No attempt has been made to utilise the enormous amount of cottonseed which must be annually thrown away at Sierra Leone. The supply would be enormous if the seeds can be profitably exported, as the plant is grown in almost every village. (See Fibres.)

*Curcas, Purging nut, Baganro, Jatropha curcas.*—The oil derived from the seeds is used in soapmaking, and has purgative properties. About 15,000 to 18,000 tons reach Europe annually, according to Semler (l.c.). The plant grows vigorously at Sierra Leone. I found it near Kitchom, No. 4,067, and again near Kambia. No. 4,624.

*Castor oil. Ricinus communis.*—This plant grows and flowers so freely at Sierra Leone that according to the Hon. S. Lewis, who has practically tested its cultivation, it yields 100 bushels of seed per acre, which, at 2s. per bushel, gives 10l. per acre. Sember, l.c., gives the yield as 1,800 kilos. per acre and says that it is worth 6l. a ton.

*Dika. Irvingia Barteri.*—The kernels contain 60 to 65 per cent. of oil, and are sometimes exported to Liverpool. The plant is said to be the wild mango of Sierra Leone, but I never saw it.

*Hyptis spicigera.*—This is a fairly common wild plant about Sierra Leone and neighbourhood. I gathered it in the Samu country, No. 4,238. The oil derived from its seeds is said to be valuable.

*Hemp. Cannabis sativa.*—Said to grow well at Sierra Leone.

*Karamui, Lufa, Papengé, Tagiri.* The three species *Luffa acutangula*, *cylindrica*, *egyptiaca*.—known under these names are pretty often seen in cultivation, and their seeds are said to yield an oil worth exporting. The loofas might also be exported as an experiment.

*Meni, Millé, Laintlaintain. Lophira alata.*—This tree is one of the commonest on all the hills from about 200 to 3,600 feet. An oil is extracted from its seeds by the natives which is used medicinally and as an unguent. The tree is so common that the quality and value of this oil should be investigated.

*Moringa pterygosperma.*—The plant has been grown in Senegambia and yields the so-called oil of ben.

*Mpofa, Mubafu. Canarium edule.*—Said to produce oil.



*Mpoga nuts. Parinarium sp.*—The kernels are said to contain oil in the proportion of 80 per cent. SIERRA LEONE  
(BOTANY).

*Mpoga. Niko.*—(I cannot discover what these oil seeds may be unless the same as *Mpoga nuts*).

*Owala, opachala. Pentaclethra macrophylla.*—The seeds yield an oil.

*Ogaguma. Tetrapleura Thonniningii.*—The seeds of this tree, which is fairly common in the high grounds, contain an oil as yet untested.

*Sogwé, Kanya, Odjendé, Butter and tallow tree, Pentadesma butyracea.*—The oily or greasy edible matter found in the fruit does not seem to have been used commercially. The seeds contain, according to Professor Heckel, 32·5 per cent. of fatty matter (especially stearic acid).

*Water melon. Citrullus vulgaris.*—The seeds yield an oil which has diuretic properties.

#### FIBRE PLANTS.

*African Bowstring Hemp, African Flax, Kruman tree fibre, Blaw, Sansevieria guineensis*, No. 4,532.—The plant is extremely common near Sierra Leone, growing on the Sugarloaf. I also found it at Kambia on the Scarcies, again at Buyabuya, and on the Talla and Falaba plateaux up to 3,000 feet. It seems to have a preference for rocks and laterite, where nothing else can grow, and propagates itself from pieces of the root stock with great rapidity.

The excellent character of the fibre is well known, and it is constantly mentioned in the Kew Bulletin and in Messrs. Christie and Sons' "New Commercial Plants and Drugs;" but so far the difficulty of preparing it for market has not been overcome in practice.

The leaves in Sierra Leone may be taken to average 3 to 4 feet in length and are produced very abundantly. It is calculated by Dr. Roxburgh that 40 lbs. of leaf gives 1 lb. of fibre, and that by planting pieces of the rhizome at 3 feet distances about 1,600 lbs. of clean fibre may be derived from an acre per annum. If properly prepared this fibre is, moreover, worth 30*l.* a ton, so that the sole difficulty in the way of producing a satisfactory trade lies in the preparation.

At present the best method known seems to me to lay the leaf on a smooth board, and a native, holding one end by his foot, scrapes the leaf from him with a thin piece of hard wood or a broad knife. If the leaves have been steeped in water beforehand this operation is rendered much easier. It might be possible to improve this process by first passing the leaves lengthwise through two horizontal rollers turned by hand and placed close together. I have also seen a method recommended of leaving aloe leaves to soak in hot-water tanks with a small amount of thyolite, but this appears not to be as yet a process thoroughly



SIERRA LEONE  
(BOTANY).

tested. The method best adapted to the West coast of Africa is one which involves no capital expenditure on the spot, and hence I am inclined to think every effort should be made to test on the spot the best means of steeping in cold or hot water, scraping and rolling.

*Agbourin, Ilassa, Bolobola, Honchenya ficifolia*, No. 5,372, 4,309.—This plant is very common on low-lying alluvial ground by rivers all through the district. I gathered it at Kitchom on the Scarcies, and again on the Niger at Farana, but it is a plant constantly seen and unmistakeable.

The fibre is said to be superior to jute in strength and worth 12*l.* to 20*l.* a ton. It is, therefore, one to be carefully tried and prepared, probably in something the same way as jute.

*Aloe, Agave, etc.*—Various kinds can be cultivated at Sierra Leone, but none are likely to do better than *Sansevieria*.

*Agbari Etu, Alafia sp.*—Yields a fibre. (Mr. Millson, Kew Bulletin, 1891, p. 214.)

*Akiri, Toja, Bunochra, Urena lobata*, No. 5,707, 5,321.—I found this plant, which is known to yield a good fibre, in the Limba country, and again on the Niger at Farana. Probably it is a fibre of the same class and requiring the same preparation as jute. It is said to be worth 18*l.* to 20*l.* a ton.

*Bamboo palm, Kélé, African Bass, Piassava.—Raphia vinifera* (and *R. Gaertneri?*), No. 5,002, 5,022).—Fibre seems to be prepared from both these species, which I was unable to distinguish when growing. The palm is extraordinarily common in low marshy ground everywhere along the coast and extends up the valleys to a considerable height. I found specimens at Cassa 10° N. lat. and Karmeninky in the Limba country, where they were almost invariably found at the heads of every small stream in almost impenetrable thickets. The leaves are about 20 feet in length and are used for rafters, poles, &c. The fibre prepared by soaking and scraping from the pulvinus and stumps of the petiole is worth from 25*l.* to 40*l.* a ton, and is a well-known article of export. Palm-wine is also obtained from the crown of the tree (see "Royal Gazette," Sierra Leone, February 28, 1891, for further details). It is scarcely possible to estimate the value of the supply still existing and which has scarcely been touched so far; but this article alone should be a profitable source of trade for many years.

The seeds under the name "Tagua nuts" are used for vegetable ivory, Kew Report, 1878, p. 49.

*Banana, Plantain. Musa sapientum*.—This plant is one of the main articles of food and grows without the slightest care or trouble in cultivation in every village in the country, from Sierra Leone to the Niger.

Whether bananas could be exported from Sierra Leone to London or not is a very doubtful matter (see under Fruits), but should a fruit trade ever be established, they will be one of the



main articles of export. There are but few kinds known at Sierra Leone, and these are not specially good, but on the other hand their price is extraordinarily low, about 8*d.* a bunch. The supply in Sierra Leone market during February 1889, 1890, and 1891, was 1,495, 800, and 1,038 heads respectively.

SIERRA LEONE  
(BOTANY).

The fruit may be dried for export as follows (Semler, l.c.); they must be picked when half ripe and kept till the skin is yellow and black spots appear. They should then be exposed to steam for three to five minutes and carefully dried in the sun, protected from flies by muslin or gauze nets. One stem will give about 60 lbs. in 14 months.

As fibre it can, perhaps, scarcely compete with other substances, but is scarcely yet practically tried. Usually the old stems are cut into four lengthwise, the soft heart is taken out and the pieces, after being left lying two or three days, are passed lengthwise through two horizontal rollers and washed. A tree yields about 4 lbs. of fibre, which is worth from 12*l.* to 20*l.* a ton. Waste stems might be profitably utilised in this way, though a plantation for fibre purposes could scarcely pay.

*Cotton, Gossypium barbadense.*—This plant is cultivated everywhere in the district traversed by the Expedition from the coast to the Niger, and large plantations may be seen whenever the natives are of an industrious nature. Bushes of a large size, 10 feet high and 15 feet in diameter, may be seen at Sierra Leone. It appears to grow quite as well on the ordinary red ironpan and gneiss as on the alluvial plains, and appears to require the very slightest possible attention.

The quality is not good, being only about 1 inch long in staple, and cannot be easily spun over 30 hanks; it is, therefore, only worth about 5*d.* to 6*d.* a pound in Manchester (Manchester Chamber of Commerce, Kew Bulletin, 1890). The cotton grown in the country is worked into a fairly strong coarse sheeting by the natives in every village. It is first combed or carded by means of two brushes (boards 6 by 9 inches with handles) studded with vertical steel wires. The lengths are spun into thread and apparently have to be wound and rewound two or three times before the thread is in a fit condition for weaving. This process of winding seems to require exposure, and sometimes one sees the threads pegged out in a great square with sides 40 or 50 feet along, round which a slave with the spindle walks carefully.

The loom is a simple and ingenious piece of mechanism worked partly by the feet.

In 1808 about 10,000 lbs. were exported to England by Messrs. Anderson. The Hon. S. Lewis, in a paper on the agricultural position of Sierra Leone, says that "taking into account the price of labour (1881) the proceeds per acre would be 6*l.* 5*s.*, at a price of 3*d.* a lb. on the spot." Semler (l.c.) gives the yield per acre as 750 kilos. There is a machine, Clarke's Seed Cotton Cleaner, which costs only 15*l.*, and weighs 110 kilos, and if such a machine were employed at Sierra Leone, probably



SIERRA LEONE  
(BOTANY).

both the fibres and the seeds could be even now exported with profit.

Experiments have been lately made by Dr. Easmon which show that Egyptian, Sea Island, and five other varieties of cotton, can be grown on the Gold Coast, especially on irrigated alluvium.

The leaves are also of considerable medicinal importance.

*Coco-nut Palm. Cocos nucifera.*—A plantation of these trees was made by the Hon. S. Lewis in 1883 at Christiansville, and one is now in full bearing. They are planted on low, rather sandy alluvial, and 30 feet apart. They suffer severely from the larva of a beetle which bores into the heart of the tree and eats away the whole of the young growing tissue. A labourer is sent twice a day to look out for this beetle. He calculates that these palms will yield on an average 2s. 6d. per tree after paying all expenses. The long established trees at Sierra Leone are said to produce 12 dozen nuts annually. On the other hand, Semler states that these palms only give on an average five dozen nuts, and that 1,000 nuts are worth 23l. for copra, and 14s. to 20s. for coir; from which each tree would produce from 20s. to 30s. per annum. The palm is certainly well suited to the coast districts and from the preceding it would seem to be very profitable, provided insects can be guarded against.

*Sago palm. Sagus rumphii and Sagus lævis.*—This plant might be tried at Sierra Leone.

*Country Rope. Vitis urenæloba.*—A common creeper in the bush and at Sierra Leone, which is used as ropes by the natives. The fibre might be tried.

*Canes, Rattan, Tambi, Calamus barteri*, Nos. 4,460, 4,738, 5,121.—One frequently sees in houses long smooth canes from 20 to 30 feet in length and not much more than an inch in diameter. These are made from a climbing palm which is pretty common at the heads of streams in black alluvial soil, and there forms quite impassable screens of barbed, thorny leaves. They should certainly be worth something in this country as they are both strong and light. They are used by the natives for ropes. I found it at Kambia and again at Falaba.

*Entada scandens*, Nos. 5,227, 5,520.—This plant is fairly common in the bush, and is said to yield a fibre. Its seeds are also said to be emetic. I found it at Erimakuna on the plateaux of iron pan and also in the Limba country.

*Jiawi. Turraea heterophylla*, No. 4,751.—The bark is used as a fibre; found near Wallia on the Scarcies River.

*Hpokpoka. Tabernæmontana crassa.*—This plant is said to yield a fibre.

*Ingiwoya. Scleria Barteri.*—Judging from the extreme toughness of this plant, it ought to produce a good fibre.

*Jodo, Buaze, Securidaca longepedunculata.*—Said to yield a fibre.



*Ingli, Jute, Corehorus olitorius*, No. 5,228, 4,071, *Corchorus angularis*, No. 5,679. The first is pretty often cultivated and I gathered it at Somaia in the Samu country and at Falaba; the second only in the Limba country. SIERRA LEONE  
(BOTANY.)

There would certainly be no difficulty in cultivating the plant for its fibre, but whether this could be done in competition with the Indian supply, it is very difficult to say. It is worth 8*l.* to 13*l.* a ton, and is said to yield 5 to 30 cwt. per acre.

*Jawki. Holarrhena africana*, No. 4,469, 4506.—The seeds are furnished with plumose feathers which are used for stuffing pillows, etc.

*Kuka, Monkey bread, Shahjo, Andansonina digitata*.—The bark is said to furnish a useful fibre (*see* under Fruits).

*Kukomboya, Sterculia canescens*.—The bark is said to furnish a fibre (Moloney, l. c. p. 287).

*Ochro. Hibiscus esculentus and H. abelmoschus*.—These plants are frequently cultivated in the whole colony, but particularly at Sierra Leone and near the sea coast. They are used as a vegetable with rice. The fibre of the first is said to be worth (Kew Bulletin, 1890) 18*l.* to 20*l.* per ton. The preparation should be probably similar to that of jute. Semler l. c.) gives some hints as to its cultivation. The seeds “Graines d’ambrette” are used in perfumery in France.

*Oshek potu funfun* (name from Millson, Kew Bulletin, l. c.), *Sida carpinifolia*.—This plant is pretty common at Sierra Leone, and is said to give a good fibre of the jute kind. It is also used in soap making and for gonorrhœa (Millson l. c.)

*Rosella Hemp*, *see Soursour* (Vegetables).

*Pine apple. Ananas sativa* (*see* under Fruits).—The fibre of the leaves is said to be excellent; a rope  $3\frac{1}{4}$  inches in diameter of this fibre stood a strain of 5,700 pounds without breaking. (Journ. Agr. Soc. of India, Vol. 3, p. 182). It is prepared much in the same way as Bowstring Hemp, and if it can be profitably extracted anywhere, it ought to be easily worked at Sierra Leone.

*Cotton or Silk cotton tree, Onia, Kapok. Eriodendron anfractuosum*.—This fine tree is to be found in every village and along the roads, &c., from Sierra Leone to the Niger. The feathery wool of the seeds has been shipped both to Holland and Melbourne for use in stuffing mattresses and furniture. In 1886 (Semler l. c. Vol. 3, p. 732) 8,845 bales were exported to Melbourne and brought about 26,850*l.* (selling at about 6*d.* to 8½*d.* a lb.) The seeds are worth 4*l.* to 8*l.* a ton for oil, and a kind of gum is obtained from the bark.

Other fibres, which might be easily cultivated at Sierra Leone, are derived from—

*Sida rhombifolia*, No. 3,897, found at Sierra Leone, and No. 5,714, in the Limba Country.

*Wissadula rostrata*.

*Malachra capitata*.



SIERRA LEONE  
(BOTANY).

*Abutilon indicum*.

*Hibiscus tiliaceus*.

*Hibiscus cannabinus*, No. 4,041 Mahela ; No. 4,592, Kora river.

*Sparmannia africana*.

*Triumfetta semitriloba*.

*Corchorus tridens*.

*Corchorus trilocularis*.

*Crotalaria retusa*.

*Crotalaria juncea* (Sun hemp).

#### DYE PLANTS.

*Arnatto*, Country Camwood, *Bixa Orellana*, No. 5,867, 4,328.—I have found this tree cultivated in one or two places about Kambia and near Port Lokko. The seeds are worth from 1*d.* to 3*d.* a lb.; the paste prepared by pouring boiling water with acid over them and straining and crushing, is worth 6*d.* to 1*s.* 8*d.* a lb. (see Dr. Macfadyen in Kew Bulletin, 1890, p. 142). The total imported is, however, very small.

*Barwood*.—Apparently same as Camwood, or according to others is *Pterocarpus angolensis*.—(See *Kino*.)?

*Camwood*, *Baphia nitida* (*Baphia laurifolia*?) seems to be absent from the district traversed; another species, *B. polygalacea*, is extremely common (Kambia, Limba, Sherboro).

*Country blue*, *Élu* (Yoruba) *Ngepassa*, *Nialé* (*Mendi*), No. 5,284, 5,722, 5,739, 4,786. *Lonchocarpus cyanescens*.—This valuable plant was first noticed by Barter in 1859, and appears to be very common in the whole country we traversed, from Falaba to Kambia, and about Sierra Leone and Sherboro. The plant is a shrub or small tree usually kept small and bushy by the natives. The leaves furnish a blue dye which appears to be stronger and more permanent in character than Indigo.

To produce this the leaves are gathered young and powdered in a mortar into a black paste, which is worked into balls about 6 inches in diameter.

One ball is used per each gallon of water. This description is mainly from Barter, and his account has been confirmed by others and what I have myself seen. The plant being a wild one, and growing without any care or cultivation worth mentioning, it is distinctly one of the very first products to be thoroughly studied by planters and traders on the coast. The Indigo-like dye derived from it is worth, according to Governor Moloney, 4*s.* to 4*s.* 6*d.* a lb. If this is correct, cultivation would be certainly profitable, though at first buying from the natives might be more advisable.

The root of the plant is said to cure leprosy and be of use in caaract (Dr. Davies, Sierra Leone).

*Fayar*, *Feru* (Millson), *Dundake* (Christie), *Cochlospermum tinctorium*, No. 4,132.—The roots of this plant furnish a yellow dye and are also said to have medicinal properties (amenorrhœa &c.)



*Craterispermum laurinum*.—A tree very common all over the district traversed by us. The bark furnishes a yellow dye which is used considerably by the natives. No European has investigated it practically to my knowledge.

SIERRA LEONE  
(BOTANY).

*Furé. Grumilea psychotrioides*.—An undershrub in the woods about Farana, furnishes a red dye, used by the natives for cloth.

*Inguli, Baub. Vitex Cienkowskii*.—A tree, very common over the ironpan plateaux from 500 to 3,000 feet, has seeds which are used for ink.

*Jauwi. Trichilia Hendelotti Planch*, No. 4,620, 5,496, 5,605, 4,986, 4,542.—A tree, whose bark furnishes a red dye used for cloth by the natives at Kafogo, in the Limba country.

*Gbeyido (Wusu) Xylopi polycarpa*?—The bark yields a yellow dye and is also used medicinally for ulcers, &c.

*Henna or Jagwi. Lawsonia alba*, No 4,314. Is also cultivated at various places along the Scarcies and the Talla plains for local use.

*Indigo, Country blue.—Indigofera Anil* is widely cultivated about Kambia and in the Samu district, and is also common in a wild state in the hills behind Sierra Leone. *Indigofera tinctoria* is also wild at Bathurst, Gambia.

The process employed is a primitive and careless one. The young branches are gathered and left in heaps in the sun to rot, until, in fact, decomposition begins. They are then boiled in a large vessel; the water is allowed to cool and then the cloth is placed in it together with pieces of a root (? mordant) which I could not obtain. The cloth is very often tied up in various knots and folds, and as such tightly tied up parts remain undyed they produce a pattern sometimes of rather a tasteful character. The result is so good, particularly in the Sherboro and Mandingo country, and the plant grows so freely without the least care or trouble in cultivation that it is possible its cultivation might be profitable. It is, however, improbable that anything but a low-priced indigo could be produced without machinery and supervision. (A sample sent to Mr. Christie was valued only at 6*d.* a lb.)

*Mangrove, Rhizophora racemosa* (?) (See *Timbers*).—The bark when burnt with soda is used to stain floors dark red.

*Okka, kupkpaw Sorghum vulgare*.—This furnishes a red dye. (See Millson, Kew Bulletin, 1891.)

#### GUMS.

*Senegal Gums and Gum Arabic. Acacia Verek, Neboured, albida, Adansonii and arabica*.—I have not seen any of these valuable plants even on the Niger, where one would have expected them to occur. I do not know if *Acacia ataxacantha*, Nos. 4,457b and 4,293 have been tested for gum.

*Albizzia Brownei*.—This plant is said to yield a valuable gum and occurs in the district. I have it from Wullia on the Upper



SIERRA LEONE (BOFANY). Scarcies, and from Falaba, Nos. 4,151, 4,581, also in the Limba country, No. 5,560.

*Buaji, Hogplum, Spondias lutea* No. 4,762.—A good deal of strong gum exudes from the stem of this plant, which is, at any rate, worth investigation.

*Kobo. Sierra Leone Copal, Copaifera Guibourtiana*.—This plant occurs at Sierra Leone, but I did not find it (*see* Kobo), and produces valuable gum.

*Koboi, Cryptosepalum tetraphyllum*, No. 4,537.—This plant is abundant in the Talla hills, Limba Country, and at Sierra Leone, and the properties of a clear resinous gum obtained from it, require investigation.

*Euphorbium Gum* (obtained from the Camaroons).—I cannot find out what this plant is.

*Frankincense tree, Ogeagum, Santang, Daniella thurifera*.—This plant is not common at Sierra Leone. It yields a fragrant resin which appears to be of value.

*Kobe, Oba, Sterculia tragacantha*, No. 4,465.—This plant is said to yield gum tragacanth, and is frequently used for fences, &c., in the neighbourhood of Buyabuya, on the Scarcies.

*Silk Cotton tree, Eriodendron anfractuosum*.—Gum is obtained from this tree, but it is not used commercially (*see* fibres).

*Symphonia globulifera*.—Gum is obtained from this species, which is not uncommon in the district.

*Quinjé, Yetta, Ophiocanlon cissampeloides*, No. 4,975.—The resinous juice pressed out of the stems of this creeper is used to make earth floors smooth and glistening.

#### FORESTS AND TIMBER.

*Peninsula of Sierra Leone*.—Most of the forest in the immediate neighbourhood of Sierra Leone was cut down for export many years ago in the period during which the timber trade was one of the most important industries. Even now, however, there is a good deal of virgin forest, with much valuable timber in the more distant parts.

From the top of the Sugar Loaf, every mountain visible seems to be covered with forest, which, from the dark green tints of the foliage, appears to have been never interfered with. When, however, one goes into any of the numerous valleys amongst these hills, one sees that cultivation is being carried on along the lower levels, and is also creeping up the sides of the hills themselves. Moreover, after an altitude of 2,000 feet has been reached, the forest has rather a stunted and dwarfed appearance. Large trees are the exception; most have a diameter of 9 inches to 1 foot only, and some are mere shrubs and commercially useless. Probably, also the really valuable woods are nearly extinct, though on this point I cannot speak with any certainty. If one considers the preceding facts (the clearing of the valleys and the



stunted growth of the summits) one cannot consider the amount of good timber in the Peninsula as being very important. Probably there are from 7,000 to 10,000 acres of timber in the Peninsula. This is, however, almost invariably inaccessible. The streams are too small to float the logs, and until there are good and cheap means of transport, the forests cannot be made use of on a large scale. A good waggon track from Waterloo to Hastings and Lumley, and from Sierra Leone to Regent, York and Kent, with introduction of trained bullocks, might render the working of these forests commercially profitable; but even this is doubtful. Nothing would confer a greater benefit on the Peninsula than two such roads and the destruction of most of the forest. The climate is too humid for the rainfall to be dangerously diminished, though of course the valleys which contribute the water supply of Sierra Leone should not be denuded.

*River-woods in the back country.*—It is almost an invariable rule, that every river and stream possesses a belt of forest from 50 to 100 yards wide on each bank. The trees in these river belts are sometimes of considerable height; generally, however, they are not of very valuable kinds. It would, I think, be possible to utilise a considerable amount of this timber, as, although the Scarcies is not navigable beyond Kambia, there is no particular reason why the logs should not be floated down the river in the rainy season. Allowing 10s. per tree, one might estimate the value of the riverside timber of the Little Scarcies as 10,000l. The cost of felling would not be great, but that of passing the logs over the rapids and shallows would be very considerable and perhaps scarcely profitable. Every river we saw, however, possesses such belts, and except in such places as Farana, where the Niger flows through a broad alluvial valley, and by its winding destroys the woods along its banks, they are fairly continuous. These belts of timber continue up the various streams and tributaries almost to their source, becoming, however, much shorter and smaller towards the end.

*Forests noticed.*—Really valuable and extensive forest is almost non-existent on the route which we followed. From Waterloo, the valley of the Rokelle and the Kwaia (Quiah) district appear to be covered with dense and valuable woods, but this district was outside our experience. There is, however, some really good timber near Layah and near Dimbaia on the road from the former place to Kofiu. Between Kundita and Sellikuri again we passed through about two miles of fine valuable forest, probably extending backwards a long distance into the hills. About Berria and Erimakuno there are also fine strips of riverside timber. The best, however, we saw was in some of the deep narrow valleys between Musaia and Bumban, particularly at Kongoba and Bafodeya. These last, however, could scarcely be brought to market, and are being rapidly destroyed.

The manner of growing rice and other crops in the more distant and primitive parts of the colony, is very destructive. Every



SIERRA LEONE  
(BOTANY).

shrub or tree on the spot chosen is cut down and after having been left seven or eight days to dry, is burnt to the ground. This process we saw going on at different points on our journey (for instance, between Bafodeya and Bumban), and it is probably on account of this that the amount of valuable forest seen by us was so inconsiderable.

*Plateaux.*—Isolated trees 20 to 30 feet high and some 50 to 60 feet apart, cover enormous areas of the plateaux 2,000 to 3,000 feet in altitude. The country cannot be described as park-like, nor are the trees close enough to form a wood. They belong chiefly to six or seven species, all of which are distinguished by possessing a very thick gummy or resinous bark. This protects them from the numerous fires which in the dry season burn the thick grasses three to four feet high between them.

*Lower Slopes.*—The wasteful method of cultivation adopted (*see above*) is against the formation of new forest after it has been once cut down. Trees are never allowed to grow for more than eight to ten years. Then comes the periodical clearing; the bush and young trees are cut down and burnt; the land is cultivated two to five and then abandoned.

*Conclusion.*—Along the route followed by ourselves the investment of capital in forest clearing cannot be recommended. If the country should ever be opened up by roads or railways, a considerable amount of timber might be obtained, but at great expense. Generally speaking, the amount of trees varies inversely with the population and industry of the people.

I took a great deal of trouble in trying to procure timber specimens for experiment in this country, but the specimens brought back have yielded no favourable results. They were rather too small for testing properly, owing to a misconception on my part as to the size required. They have been submitted to Messrs. G. Saunders & Co., as well as to Messrs. A. Ransome, but they report that none are worth importing to this country. I have embodied the few verbal notes, for which I have to thank Mr. Saunders and Mr. Ransome, in the list which follows.

The following are the names and properties of a small collection made at Kambia on the Scarcies:—

1. *Kronko Griffonia pallescens*.—A tree, about 30 feet.
2. *Kelabu Salacia pyriformis*.—A common tree, 40 feet or so.
3. *Konta, Berlinia auriculata*.—A very hard wood used chiefly for furniture. Abundant everywhere.
4. *Akbaha (Timmenie) Tora (Susu) Ficus Vogelii*.—When planed is beautifully smooth and good.
5. *Kon or Kokon*.—The hardest African wood; this is said to last 100 years in the ground, and is not affected by the white ants.
6. *Katé. Combretum glutinosum*.—Good, hard, tough timber used for thwarts, &c., of boats. Small tree.
7. *Fundaba*.—Very like pine, lasts well in the water and is used for canoes.



8. *Katulonga*, *Gaertnera paniculata*.—A rather brittle wood. SIERRA LEONE (BOTANY).  
 9. *Katima*.—This is used for canoes; grows to a large size and is abundant at Kambia.  
 10. *Oboi*, *Haronga paniculata*.—A strong tough wood; used for canoe paddles, but is small in diameter.  
 11. *Yagalé*.—A strong wood used for keels of boats; this is said to resist the white ant.  
 12. *Kantingi*, *Anisophyllea laurina*.—This is used for rowlocks.  
 13. *Kobotué*.—Housework, doors, &c.  
 14. *Dundaké*. *Sarcocephalus esculentus*.—This is cut into boards and used for tables.

The second collection made at Sierra Leone consisted of the following:—

1. *Grigri* (*Aku*) *Avicennia africana* (Garigara, see Moloney, 1. c.).—Used for housework.
2. *Téma* (*Timmenie*).—Legs of tables, &c.
3. *Simé*.—Roofs of houses, &c.
4. *Mammi Apple*, *Ochrocarpus africanus*.—Good for most of the ordinary work.
5. *Blue Bessi* (*Timmenie*).—Roofs of houses.
6. *Almond*.—Housework.
7. *Brimstone*, *Morinda citrifolia*.—Housework and ordinary purposes.
8. *Cedar*, *Khaya senegalensis*.—Tables and cabinet work, said to be worth  $4\frac{1}{2}d.$  to  $6\frac{1}{2}d.$  per foot superficies.
9. *Konta*, *Berlinia*.—Best of all kinds of cabinet work.
10. *Karri*.—A very good strong wood; easily worked in cabinet work, but not common.
11. *Bocombo*.—Strong and tough, used for wheels.
12. *Sugar plum*, *Parinarium*.—Common, and used for rough work.
13. *Makant* (cf. *Cedar*). *Khaya senegalensis*.—Fine grain for outside of cabinet work; not common.
14. *Kontakobong*.—Fine grained but ropy, common.
15. *African Oak*. *Oldfieldia africana*.—Used for all strong work and one of the best.
16. *African Rosewood*. *Pterocarpus erinaceus*.—Dark furniture, probably of value for imitation of old oak, &c., very common.
17. *Kankan*.—Used for trucks and rough work.
18. *Roughskin Plum*.—Not often used.
19. *Spice*, *Xylopiæ æthiopica*.—Not often used.
20. *Coffee*. *Coffea stenophylla*.—For walking sticks.
21. So-called *Ebony*, *Diospyros* sp.—Walking sticks.
22. *Karott* (*Timmenie*).—For planks and boat-building, but rare.
23. *Monkey Apple*, *Anisophyllea laurina*.—Posts for houses, &c., usually of small size.
24. *Bop*.—A large tree used for canoes.
25. *Karunk*.—Used for canoes.
26. *Wissmore*.—Boat-building.
27. *Kundi*.—Rafters of houses, &c.



SIERRA LEONE  
(BOTANY).

28. *Mangrove. Rhizophora racemosa*.—Rafters, &c.
29. *Ironpost*.—Rather hard to work, but very good for posts, resists white ants; very common.
30. *Sassa. Erythrophleum guineense*.—Tables and ordinary housework; is easily stained and easy to work.
31. *Camwood. Baphia nitida*.—Used for walking sticks.
32. *German Steel*.—Very hard to work, but good for turning; table legs, &c.
33. *Water Oak*.—A hard wood used for cabinet work and common.
34. *Bastard Mahogany*.—Cabinet making and very common.
35. *Ironwood*.—Good for turning.
36. *Wattle*.—Boards, &c.
37. *Black Tomblas*.—Scantlings.
38. *Kola. Kola acuminata*.—Boards, rare.
39. *Rose Apple. Eugenia sp.*—Rare.
40. *Comma*.—Takes stains well.
41. *Kokan*.—Used for keels, &c.
42. *Black Tamarind*.—Boat-building.
43. *Gbambé*.—Keels and boat thwarts.
44. *Black Mangrove*.—Thwarts, &c. in boats.
45. *Gbeck*.
46. *Paw*.
47. *Bongbo. Cassia Sieberiana*.—A tree about 30 feet.
48. *Finger-root. Uvaria Chamæ*.—See Medicinal Plants.
49. *Antoni*.—An extremely hard wood.
50. *Milkwood*.
51. *Baboo bone*.—A very hard wood.

The following kinds are pretty common, but I did not bring specimens:—

*Crabwood, Carapa guyanensis*.—A tall tree some 50 feet in height and fairly common.

*Odum, Chlorophora excelsa*.

*Kino. Drepanocarpus senegalensis*.—Fruit consists of 75 per cent. tannin.

*Mangrove, Rhizophora mangle*.—Bark yields a tannin which is not, however, recommended.

## BAMBOO.

The mountains about the upper waters of the Scarcies rivers and also at Falaba, produce an abundance of bamboos usually about 20 feet high and 3 inches diameter. These are, as a rule, hollow stemmed, but are of considerable strength and used locally for many purposes. The quantity available is enormous, but probably being nearly 300 miles from the coast it is impossible to have them brought to market. They grow on mountain sides and usually kill out every other plant, and they seem to prefer dry rocky ground. The only specimen in flower which I saw is too poor for determination, but it is almost certainly a new species of *Bambusa*.



## FRUITS.

SIERRA LEONE  
(BOTANY).

The question of an export trade in fruit has been frequently raised at Sierra Leone.

Whether such a trade could be carried on depends on several factors which are not very easy to estimate.

The chief of these factors are: 1st. Present supply and price of fruit at Sierra Leone; 2nd. Cost of freight; 3rd. Time of passage; 4th. Price in London depending on the supply from other parts.

1st, *Supply at Sierra Leone*.—The present supply, depending entirely on local demand, is insignificant, as will be seen from the following table giving the amount exposed for sale in Freetown during February in 1889, 1890, and 1891:—

| —                     | 1889. | 1890. | 1891. |
|-----------------------|-------|-------|-------|
| Banana, heads - -     | 1,495 | 800   | 1,083 |
| Cocoanuts, dozens - - | 138   | 6     | —     |
| Ginger, bags - - -    | 2,531 | 119   | 135   |
| Orange, baskets - -   | 211   | 697   | 19    |
| Plantain, heads - -   | 1,413 | 623   | 1,354 |

One cannot, however, really take this as any measure of the possible supply, supposing an export trade established. No soil and climate in the world is better adapted for bananas, pine-apples, oranges, limes, and other fruits than Sierra Leone. The price of land is 4s. an acre, and good labour may be obtained usually for 3d. to 1s. a day. Under these circumstances it seems to me that fruit could be supplied in any quantity and at a lower price in Freetown than is the case in any fruit exporting country known to me. One may, I think, say that the possible supply is unlimited. The present prices are almost nominal.

Thus, the Hon. S. Lewis gives the following list:—

Pineapples (January to June) 10d. a dozen.

Banana (all the year) 8d. a head.

Cucumber (December to March) 6d. a dozen.

Guava, 2s. a bushel.

Limes, 6d. to 8d. a hundred.

Mango, 3d. a dozen.

Of course the prices could not be kept so low if an export trade were established, but after the lapse of a few years, supposing such a trade maintained its ground, the results of plantation on a large scale would bring the prices back to nearly their original condition. Plantation on a large scale usually enables produce to be sold at a lower rate than is possible when plants are grown in small quantities and in a haphazard and miscellaneous way. These prices are of interest only as showing what is possible under the present conditions of labour, climate, and soil.



SIERRA LEONE  
(BOTANY).

2nd. *Price in London*.—The price of fruit varies so much, according to season, and condition that there is but little use in giving it. The following, however, shows what a difference exists between the retail price and those given above:—

Bananas, 7s a head or  $\frac{1}{2}d.$  to 1d. each.

Mangos, 4s. a dozen.

Pineapple, 4s. each, or from 30s. to 50s. a dozen.

Pomegranate, 3s. a dozen.

Limes, guavas, &c. scarcely known.

3rd and 4th. *Cost of Freight and Time of passage*.—The distance from Sierra Leone to Liverpool is so great that, with the present lines of steamers, no export of fruit is likely to pay.

In fact, the present steamers are so uncertain in arrival and departure, very often so crowded with other produce, and so slow (scarcely averaging 10 knots an hour) that export of fruit is quite impossible on a large scale. The deterioration arising from the length of the passage would in itself be sufficient to destroy the prospect of a profit. Even under present conditions, however, I found that bananas and pineapples *can be carried* if they are kept in a cool and breezy place, though this only applies to small quantities, which can be carefully looked after.

A line of fast steamers built specially for fruit traffic, and running direct from London to Sierra Leone, might, without difficulty do the whole distance in less time than is taken by the ordinary British and African Steam Navigation Company's vessels in going from Teneriffe to Liverpool, and as the fruit trade from the Canary Islands to Liverpool by these boats seems to be a success, and to be yearly on the increase, such a line to Sierra Leone ought to be very much more profitable. But if such a line of steamers were started, they certainly could not get full cargoes of fruit for several years to come, and the enterprise would on the whole be of a very speculative character. That it would eventually pay seems to me extremely probable.

*Fruits*.—The more important fruits of Sierra Leone are the *Banana*, which is almost a necessary article of diet, and which has been already noticed (*see* Fibres). Others of importance are:—

*Mango*. *Mangifera indica*.—Every village possesses one or more of these trees, and their dark green foliage is an invariable sign of the presence of native huts. The kinds, however, are stringy and poor in quality, and some effort might be made to introduce, say, the "Cherry" mango and other good West Indian kinds.

*Popow*. *Carica papaya*.—This is very common in the whole district from sea-level to Falaba. They grow with extraordinary rapidity at Sierra Leone, reaching a height of 12 feet in about 6 months, and reproducing about three years after sowing. The fruit is pleasant and refreshing, and the seeds have an extraordinary resemblance to mustard and cress.

The use of "papaine" derived from the fruit has been rapidly spreading in England lately. It is a very valuable digestive, a



remedy for threadworms and tapeworm, and is also of great use in croup and diphtheria. This drug is sold in England at about 1s. per drachm, and its preparation at Sierra Leone should be an extremely profitable matter.

SIERRA LEONE  
(BOTANY).

*Pine apple. Ananas sativa.*—This plant is almost wild in many places, and seems to grow wherever placed without the least attention. We found it common about Sierra Leone, and again along the Scarcies, and even as far up country as Falaba. It grows as a rule on the laterite or ironpan hills, but it is said that if planted on good alluvium very large fruits can be obtained with a little attention. This must, however, be neither too stiff, so as to hold water, nor of too sandy and dry a character. They should be planted out from off-shoots at from three to four feet distances at the beginning of the rains, and they ripen in 14 to 20 months. Development from seed takes 10 to 12 years. The price of the present small and inferior kind sold at Sierra Leone varies from a  $\frac{1}{2}d.$  to  $1\frac{1}{2}d.$  each. This fruit is one of the most important if an export trade is ever formed.

*Limes, Oranges. Citrus medicus, aurantium.*—These grow extremely well over the whole district traversed by the expedition. The oranges are of fair quality considering the utter absence of care in cultivation, but the skin is very thick and usually green in colour. Limes are abundant and of excellent quality; they are extremely valuable as a means of inducing perspiration in fever. The manufacture of lime-juice is one which might be tried at Sierra Leone. The fruits are at Montserrat torn to pieces by a toothed cylinder and the juice flows through a sieve into tanks; the pulp on this sieve is pressed in jute bags to extract a further amount of juice. The oil in the peel is extracted by rolling the limes (or oranges) over a shallow tin basin, or rather sink, which has four circles of upright teeth about half an inch long, arranged upon this (this is called an "Ecuelle à piquer"); the oil passes through a hole in the centre and flows into bottles or tanks. The following fruits are of less importance, though common and easily grown at Sierra Leone.

*Akee Blighia sapida.*—A tree some 30 feet high; the arils are eaten.

*Avocado Pear.*—*Persea gratissima.*

*Black Plum, Dawi.*—Two plants are known by this name. *Vitex megaphylla* Baker and *Parinarium excelsum*.

*Batui. Pterocarpus esculentus.* No. 4,789.

*Custard Apple. Anona reticulata.*

*Cherimoyer. Anona cherimolia.*

*Carpolobia alba.* No. 5,474.—A very common shrub, has edible fruit.

*Country Grapes. Vitis caesia.*

*Damson, Hogplum. Spondias lutea.*

*Doi, Dundaka. Sarcocephalus esculentus.*

*Dité, Dattock. Detarium senegalense.*



SIERRA LEONE  
(BOTANY)

*Figs.*—The common fig grows well at Sierra Leone, and there are numerous edible figs amongst the wild forms. These are usually called *Gongo*, *Gongwi*, or similar names. The bark of several kinds is chewed with Kola-nut (No. 4,468 *Ficus platyphllum*, No. 4,656 *Ficus* sp. nov., No. 4,289 *Ficus trachyphylla*).

*Fofoi.*—*Myrianthus* sp. No. 4,811.

*Gingerbread Plum.* *Parinarium macrophyllum*.—Rather rare.

*Guava.*—*Psidium pyriferum*.—Common.

*Gengeseng*, *Kushumin*, *Carpodinus*, sp. nov., No. 4,924, has edible fruits, as also *Carpodimus edulis* and the *Pishamin* *Carpodinus dulcis*.

*Grewia*, spp.—Several of these are eaten by the natives.

*Ile.* *Uapaca Heudelotii*.

*Kitangi.* *Eugenia michelini*.

*Kunyakumé.* *Ochna* sp. nov.

*Locust*, *Nadi*, *Nette*, *Parkia biglobosa*, No. 4,771. This tree is one of the very commonest from Freetown to the Niger plateaux. The fruit is sometimes eaten, and a decoction of the leaves mixed with goat's milk is a sure remedy for shingles.

*Mammee Apple*, *Tula*, *Ochrocarpus africanus* (Timbers).

*Monkey Apple.* *Anisophyllea laurina*, Nos. 5,864, 5,436.—This shrub is almost invariably found whenever a clearing has been abandoned, and the original bush is springing up again. The timber is of good quality, but the shrub rarely becomes more than 30 to 40 feet in height. Another plant, *Trichilia Prieuriana*, also goes by this name.

*Monkey bread.* *Adansonia digitata*.—This handsome tree is also very often planted throughout the district. The fruit is about 9 inches long, and has a hard shell. The pulp coating the seeds has an agreeable sub-acid flavour. Also yields a fibre.

*Monkey Guava.* *Diospyros mespiliformis*.

*Melon.* *Cucumis melo* (see *Agusi* in oil plants).

*Passion flower*, *Grenadilla*.—Both frequent at Freetown.

*Pomegranate.* *Punica granatum*.

*Rose apple.*—A West Indian species of *Eugenia* is grown under this name.

*Roughskin Plum.* *Parinarium excelsum*.

*Sapodilla.* *Sapota Achras*.

*Sweetsop* and *Soursop.* *Anona squamosa* and *muricata*.

*Tamarind* (black), *Tomblas*, *Tamarindus indicus*.—The fruit of this tree, common at Sierra Leone, is occasionally dried for export in other places.

*Velvet tamarind*, *Dialium guineense*.—This is extremely abundant in the bush near Sierra Leone, and grows up to 3,600 feet. The natives are very fond of it.

*Wild Mango.* *Irvingia Barteri*.

*Water melon.* *Be'raf.* *Citrullus vulgaris*.



## CEREALS AND VEGETABLES.

SIERRA LEONE  
(BOTANY).

*Rice. Oryza sativa.*—This forms the main article of food in most parts of the district. It is grown in two distinct ways. First in the stretches of alluvium common beside rivers and streams, and usually overflowed in the wet season. The cultivation in these places is carried on in the ordinary Indian and Burmese manner, except that it is of a much rougher and simpler kind. Second, in the higher valleys of the Limba country, where the natives occasionally cut down large stretches of forest, which are burnt on the spot before the rainy season begins. The rice is sown on the dry ash-covered grounds, and springs up during the rains. This method is both extremely laborious and extremely wasteful, as the fine timber resulting from 60 or 70 years' growth is destroyed. It should not be permitted in any place where timber can be profitably brought to market. The yield of rice by the first method varies from 1,600 to 3,600 kilos per acre. The "Sierra Leone Gazette" contains the following information as to exports and imports:—

| —                  | 1888. | 1889. | 1890. |
|--------------------|-------|-------|-------|
|                    | £.    | £.    | £.    |
| Rice Exports - - - | 4,051 | 5,490 | 2,453 |
| Rice Imports - - - | 1,502 | 1,505 | 564   |

There is scarcely any doubt that the supply could be enormously increased if a fair margin of profit could be obtained.

*Wheat*—It is almost certain, I think, that wheat would grow well on the higher plateaux about Falaba and on the Talla hills, but it has never been attempted to my knowledge.

*Fundi, Fundainge, Hungry rice. Paspalum exile.*—I found this plant cultivated at Duunia, Sikuru and other places in the Talla country. The ground is carefully cleared and cut into small plots by little ridges of earth and roots, some 8 inches high. Water is thus kept in the plots, and the plant grows like rice. Its yield cannot be large.

*Guinea Corn. Panicum maximum.*—This plant is often grown in the Gambia, and I also saw it in the Samu country. It seems not to occur so frequently up country, and to be chiefly found on good alluvial ground.

*Maize. Abblé, Abiri, Agbado, etc. Zea Mays.*—This is occasionally planted on red grit or laterite hills in the lower part of the district, and I have also seen it on the Talla plateaux. It was of fair quality where seen, and appeared to grow without difficulty. No soil would seem *à priori* better suited to it than the plateaux and valleys from 2,000 feet upwards, and its comparative absence is probably due to the preference of the natives for rice. In some places in Sierra Leone three crops a



SIERRA LEONE  
(BOTANY).

year have been grown. Semler (l.c.) states that in America some kinds ripen in two months, and that the yield is from 50 to 60 bushels per acre.

*Millet. Kuskus. Pennisetum typhoideum.*—This is often grown in the Samu country and about Kambia, but seems not to be cultivated farther inland.

*Koti, Sorghum vulgare.*—Pretty common near the coast.

The vegetables most commonly used by the natives are ;—

*Cassada, Manioc, Manihot Aipi.*—This is the main article of diet throughout the whole country, but is not so universal above 2,000 feet. It yields enormously ; Semler (l.c.) says that a square of 200 metres gives 80,000 lbs. It begins to bear in some three months after plantation, and seems to grow easily in any soil, provided the bush is cleared away.

At Sierra Leone it is worked up into a dough-like paste, and balls made of this are sold everywhere as “fufu.”

The following hints as to making tapioca from cassada are perhaps worth noting (Semler, l.c.). The rind must be carefully cut away ; the roots are then washed in running water ; then crushed in a handmill and passed in a current of water through a sieve ; they are then washed in fresh water every day for some eight days and finally dried in the sun in shallow pans, protected from insects by muslin or gauze.

*Congo bean. Akokola. Pigeon pea. Cajanus indicus.*—This plant is almost universally cultivated on red grit or laterite, &c., from the sea to a height of 2,000 feet or so. It is a shrub some six feet in height, and can scarcely be productive considering the space it occupies. It requires, however, scarcely any care in cultivation.

*Soursour. Hibiscus sabdariffa, No. 5752.*—This plant is almost universally grown in all the lower parts of the colony, from the sea to 2,000 feet. It yields a fibre and is also used as a vegetable.

The following are of less importance :—

*Awusa, Plukenetia conopsea.*—I found this near Regent, Sierra Leone ; it is said to be wild in the forest, but is often cultivated. The fruits and young shoots are used.

*Bokboi, Bopoi.*—This appears to be a general name for kinds of Ipomoea. The following three species are known by it :—*I. bonanox*, No. 4344 ; *I. coccinea*, No. 5444 and *I. selicuspis* Baker.

*Bembé, Chili, Pepper. Capsicum annuum.*—This plant grows and fruits with extraordinary abundance at Sierra Leone, and is universal everywhere.

*Bitter leaf. Vernonia amygdalina.*—The leaves are soaked in water and used for soup ; also used in palaver sauce.

*Bolongi. Basella alba, No. 4664.*—Cultivated at Kukuna.

*Bottle Gourd, Country Calabash, Lagenaria vulgaris.*

*Bore, Garden egg. Solanum melongena, No. 4957.*—Common.

*Cucumber. Cucumis sativus.*—This may be grown at Sierra Leone, but requires care.



*Ewaruda. Sparganophorus Vaillantii.*—Occasionally used for soup, and a common plant in the marshes. SIERRA LEONE  
(BOTANY).

*Ekuya, Gynandropsis pentaphylla.*—The leaves of this common weed are used for soup (*vide* Mr. Millsom).

*Folli, Indian Shot. Canna Indica.*—I do not know why this plant is so often cultivated in native villages; the leaves are used to wrap tobacco. Probably some part is eaten.

*Gourd. Cucurbita maxima.*—Rare.

*Jakatu (small), Banjangé Kofé. Solanum sp. nov., No. 4394.*—Occasionally seen in cultivation.

*Kindi. Physalis minima.*—I found this in cultivation.

*Kokoyam, Taro, Colocasia antiquorum.*—This is often seen in cultivation in the district, and appears to be of considerable importance.

*Kuji. Solanum Naumannii, No. 4955.*—Cultivated at Sikuru.

*Kukwi, Kola digitata, No. 4327.*—Used chiefly for soap making.

*Lagos Bolagi. Talinum crassifolium, No. 5790.*—Cultivated as a vegetable and used in palaver sauce.

*Musyabassa. Plukenetia conophora, No. 4688.*—The leaves are eaten by the natives with rice.

*Ndomi. Palisota thyrsiflora.*—Used commonly for hedges.

*Okro. Okra, Hibiscus abelmoschus and esculentus.*—Used as a vegetable at Sierra Leone. (*See fibres.*)

*Ondi. Amarantus patulus, No. 4653.*—Found in cultivation at Laya.

*Portulaca oleracea.*—Occasionally seen as a potherb.

*Potatoes, peas,* and other English vegetables may be grown at Freetown, but they require much care and should be put out in the dry season.

*Popondé.—Piper umbellatum, No. 4287.* The leaves of this climber, which is fairly common, are eaten by the natives.

*Pumpkin. Cucurbita pepo.*

*Rawodue. Celosia argentea.*

*Sawai or Valai. Clausena anisata, No. 4282.*—This was cultivated at Wallia.

*Shalott, Yabba. Allium ascalonicum.*—Frequently cultivated.

*Sweet Potato. Ipomoea batatas.*—This is almost universal, but seems to require some little care, and is therefore not so favoured by the natives as other plants.

*Tigernut. Cyperus esculentus.*—Common at Sierra Leone, where it is made into a kind of chocolate; it has aphrodisiac properties.

*Tassin. Solanum sp. nov. No. 4763.*—Seen in cultivation at Wallia.

*Tomato. Lycopersicum esculentum.*—This plant grows so well at Sierra Leone that it might possibly be exported.

*Yam, Bockra, Gawi, Dioscorea, No. 5056.*—These are very seldom cultivated, but the wild species are collected for food.



SIERRA LEONE  
(BOTANY).

### RUBBER.

The rubber exported from West Africa is of two kinds. One is derived from the so-called rubber-vines, which appear to be all species of *Landolphia* or *Carpodinus*; the other is derived from a tree, *Ficus Vogelii*, and possibly also from other species of fig.

The most important kinds in the district through which we passed "Oro," "Djengé," "Furé," and "Genyé" (all rubber-vines) were found in old forest, and the amount existing at present cannot be large. As mentioned before (*see* Timbers) the natives have long since cleared the land of the original primeval forest in all the parts below 1,000 feet, and the country is either under cultivation for cassada or is covered by grass or bush from 3 to 10 or 12 years old. The natives seem in most districts usually to make a fresh clearing after the bush has attained this age, and consequently these kinds of rubber do not get a chance of growing, as they all, so far as I have seen personally, prefer old forest where the trees are at least 20 years old, and the soil consists of a rich, moist humus, or is, at any rate, a mixture of leaf mould and other soils. On the other hand, on the plateaux of iron pan and gneiss from 1,000 feet upwards to 3,000 feet, the trees, though numerous, and in large part of considerable age, are too isolated, and the soil is too dry and hard for these rubbers.

In fact, the amount of rubber available from the rubber-vines depends on the amount of original forest, and this (*see* Timber) is not large in the district we traversed.

On the other hand, there are enormous areas from which rubber could be obtained, provided the district was freed from the never ceasing native wars and slave-raiding expeditions. Thus the country about Laya and Kofu mountain, as well as the Benna country, along the edge of which we passed, is full of forests and contains much rubber which would, if the roads to Kambia were safe, pass down the Scarcies River. The Fula country, lying back from the north-west corner of the English sphere of influence, is also said to be full of rubber, which would most probably come down the same way. Along the 10th degree of north latitude the country is in many places broken and mountainous, and the deeper and narrower valleys are full of dense forest (too far from a market for timber to be exported), but from which the rubber could be profitably withdrawn. There is also in all probability an enormous supply in the almost uninhabited Koronko district, and in the magnificent woody valleys about Bafodeya and other parts of the Limba country, on the Upper Rokelle and especially in the back country of Sherboro. I should think it probable that with roads made absolutely safe the supply of rubber from the colony might be doubled or even quadrupled in amount, but with the development of lawlessness and the constant native wars everywhere, but little is to be expected after the next few years, when the sources



readily reached from the coast have been drained of their supplies. It must also be remembered that the supply is one which is likely to be exhausted with increase of population and ought not to be reckoned upon for more than a few years, supposing the country were rendered safe.

SIERRA LEONE  
(BOTANY).

This, however, only applies to the above-mentioned kinds, and does not affect the supply derived from *Landolphia florida*, and the other species of *Carpodinus*. These latter plants were found in fairly open, dry ground, at from 1,000 to 3,500 feet, and are probably very abundant everywhere. The rubber yielded by them is neither so good nor so abundant as that from the above-mentioned kinds, though probably it could be immensely improved by better means of extraction.

With regard to the rubber from trees, I only found *Ficus Vogelii* once in the Niger drainage area; this is the kind found at Bassa and lower down the coast. There are about 39 specimens of *Ficus* sorts in my collection, and it is of course possible that several of these yield rubber, but the only other species of which I heard this is a new species (No. 5,754, *see below*).

On the whole the supply existing in the country we traversed cannot be considered as of great importance.

The method employed by the natives in extracting the vine-rubber is a simple and rather imperfect one. An incision is made in the climber, and a lime is used to coagulate the rubber as it flows out, and the native with this in his hand works the milk into balls (about the size of a cricket ball) in which it is carried down to the coast for sale. They always told me that they did *not* cut down the vines to get as much rubber as they could, and it is possible this is true in cases when the rubber vines are the property of a powerful chief (*e.g.*, in parts of the Limba country); on the other hand, it is very probable they *do* in most places destroy every vine in extracting the rubber, and this, of course, tends to stop the supply.

It would probably greatly enhance the value of the rubber if merchants on the coast were to adopt the method employed in South America, where the natives are supplied with small tin cups which are tied on the trees under the incision, and which are emptied from time to time into larger tin pails in which the milk is brought to the traders' station; there it is emptied into a bath of water, and the lumps which form are at once pressed into thin flat sheets, which are carefully wiped to take away the acid which exudes. The value of West African rubber might be doubled if it came to market in better condition.

The preparation of *Ficus* rubber seems to be a very simple matter. Thus, Mr. Higginson prepared 40 lbs. at a very low cost, as follows (Kew Bulletin, 1890, p. 90):—The milk was strained through muslin and left standing for 24 hours. It was then boiled with water and lime juice in the proportion of one lime to each quart bottle of milk. The rubber was then placed in perforated tin boxes, and heavy weights laid upon it so that the water was pressed out through the holes in the tin. A similar



SIERRA LEONE (BOTANY). method is described by Mr. Millson (in Kew Bulletin, 1888, p. 254), who states it is worth 1s. 6d. a lb. Mr. Millson mentions a tree only 13 years old, which was 50 feet in height, and states that such a tree yields 4 to 5 gallons of milk every second year.

The plant may be cultivated by cutting a branch off and sticking it in the ground. I noticed a few bushes in the garden of Messrs. Randall, Fischer, & Co., Sierra Leone, planted some five to seven years ago. These were on hard iron pan, and only 10 to 12 feet in height, so that probably the tree requires a good alluvial soil with plenty of moisture.

The following are the kinds found by me, and named, where possible, at Kew.

First, I have eight specimens which appear to be all included under the forms named at Kew as *Landolphia owariensis*. These scarcely seem to me to be one species, but as Mr. Thiselton Dyer is at present engaged in monographing the genus, I have not attempted to discriminate them.

These are :—

No. 3,878.—The common “*Oro*” rubber of the Susus, found on the way to Lester Park at Sierra Leone; this is the same as Barter, No. 1,773.

No. 4,500.—A rubber found at Kahreni in the Limba country.

No. 4,650 and No. 4,675, “*Djengé*” of Mendi people, found in the bush near Kukuna on the Scarcies River.

No. 4,754.—“*Furé*” of Susu people. In the Benna country near the Scarcies.

No. 5,586.—From Kahreni in the Limba country.

*Landolphia florida*.—Of this plant I have “a shrub by the river at Musaia, near Falaba, March 10, No. 5,109;” also “near Ninia Talla hills, February 17, No. 4,896;” both these localities are from 2 to 3,000 feet in altitude.

*Carpodinus* sp.—(One of Dr. Stapf’s unpublished species.) “A rubber called Genyé, very common on Kofu mountain, near Laya, Scarcies River, No. 4,611.”

*Carpodinus* sp.—“A rubber with edible fruit, found at Ninia, in the Talla hills, February 28, No. 4,924.”

*Carpodinus* sp.—(Another of Dr. Stapf’s unpublished forms.) “A rubber used by the natives at Tombia in Samu, for birdlime, December 26, No. 4,294.”

(The *Landolphas* might be cultivated under Kola trees in plantations, but probably they would require seven to eight years to mature. The *Carpodinus* sorts would be extremely easy to cultivate.)

*Ficus Vogelii* “*Akbaha*,” “*Abba*.”—“Near Erimakuna, Niger basin, March 20, No. 5,729A.”

*Ficus* sp. nov.—“A tree on the Sugarloaf mountain, Sierra Leone, which yields rubber, April 26, No. 5,754.”



The following kinds not gathered by me are worth mentioning:—

SIERRA LEONE  
(BOTANY).

*Gutta Shea*, *Shea butter*, *Butyrospermum Parkii*.—This plant is not common in the colony of Sierra Leone, and its rubber does not seem to be favourably reported on, probably partly because of the bad method of preparation. The kernels yield 40 per cent. of oil when slowly roasted.

*Gum Euphorbium* or “G. E.”—Comes from St. Paul de Loanda and the Camaroons.

*Manihot Glaziovii* “*Ceara* or *Scrap Rubber*.”—There is a fine tree in the Governor’s Garden at Bathurst, Gambia, of this plant, which is nearly 40 feet high and seems to have been planted by Governor Carter a few years ago. There are numerous self-sown seedlings in a thriving condition all round the garden. Some of these only two years old are some 8 feet in height. The cultivation of this tree is easy, as it requires no shade and thrives on poor soil; but it cannot be recommended, as experience has shown that in Ceylon trees 10 years old yielded only half a pound annually.

*Hevea brasiliensis*. “*Para rubber*.”—This plant requires a warm, humid climate, and soft soil like that found in virgin forest. It ought therefore to do well in the mangrove districts of the colony.

It has been introduced at Libreville on the Gaboon, and is doing well. It may be propagated by cuttings. In South America the trees are tapped when six years old, and when 8 to 10 years old, yield 6 lbs. annually. It seems, therefore, worth trial.

*Ficus elastica*. *India rubber*.—Probably ought to succeed on the West Coast of Africa. In India it yields, when nine years old, 6 lbs. annually.

#### AGRICULTURAL EDUCATION

Various attempts have been made to form experimental plantations at Sierra Leone. The Hon. S. Lewis mentions the following in a paper delivered on April 4th, 1881, at the Wesleyan High School. A plantation of cotton at Thompson’s Bay, formed in 1791 and abandoned in 1794 through the death of the planter. In 1792 the Clarkson plantation was formed and rice, cotton, and cinnamon were grown on about 16 acres; in 1794 a seaman called Graham without any experience was appointed to take charge of it, and after three years replaced by a stone blaster, Matthias Jonkars. Naturally the garden was ruined, and finally abandoned to a native chief in 1801.

Previous  
attempts.

Afzelius also had a garden of about an acre at Sierra Leone in 1794, and introduced many West Indian plants which are now thoroughly established.

Major-General Turner established a cotton and indigo plantation in 1826, which was soon abandoned through his death.

Governor Campbell in 1834 established an agricultural school for boys at the Bananas, where arrowroot and ginger were



SIERRA LEONE grown. This was remarkable as being a great success financially, (BOTANY). but on his departure in 1837 it was stopped.

In all these attempts the soil and climate are favourably spoken of, and the reason of their having been abandoned is perfectly clear.

It is worth pointing out also that the present population of Freetown is not one for which agricultural education is particularly desired. So far as I have seen, the people infinitely prefer shop-keeping and trading and almost every agricultural labourer will be found to be a Timmenie, Mendi, Limba, or rarely Ibo man. Therefore the establishment of any kind of agricultural education would be more for the advantage of the country boys and the colony as a whole.

A certain amount of training and the establishment of particularly coffee planting amongst the more industrious races, would be, however, so enormous an advantage to the colony that an annual expenditure of 800*l.* would be thoroughly justifiable.

The following suggestions may be of use if such an establishment is considered advisable.

The objects may be considered to be:—

*First.*—Actual teaching, by manual labour, of the best methods of growing and preparing such plants as are known already to be well suited to the climate, *e.g.*, coffee, arrowroot, ginger, and cotton.

*Second.*—Experimenting with every product which is likely to be of use, but of which the capacities are not as yet known at Sierra Leone.

Mr. Lewis, in the paper alluded to, suggests the establishment of a model farm of 5–6 acres, with an expenditure in salaries of about 400*l.* a year; but in order best to fulfil these aims, it seems to me that an agricultural school is more likely to be of use.

If such an establishment were seriously thought of, the Government could provide a house and at least 500 acres of land.

A superintendent at a salary of 250*l.* a year, with a commission of at least 20 per cent. on the profits, would be required; such a man should be sought for in Ceylon or Jamaica, as practical experience in tropical plantation is absolutely essential; he should *not* be a scientist from England.

A sum of 300*l.* a year for a small number of permanent labourers and for expenses would be required during the first few years, but in four years this would in all probability be unnecessary.

The most important point should be, however, a technical school connected with the garden; the boys should be taken from all parts of the colony and should obtain practical training in hard work and agriculture by labouring so many hours a day in the plantation; when of age, they should be supplied with



seeds and encouraged to start planting at their own homes. No doubt the Church or Wesleyan Missionary Societies would take part of the expense of such a school off the hands of Government. If the Government allowed 250*l.* a year to this school, the whole Government Grant would be only 800*l.* a year, and the benefit to the colony would be incalculable. A good site for such an experiment lies between Charlotte and Hastings; one absolutely essential point is that the place must be at least seven miles out of Freetown.

Of course the expenditure and proceeds from every plant grown should be clearly visible from the books, and these should be open to the inspection of every visitor. A limit should also be set for the cultivation of every single plant in case the superintendent should devote all his attention to the most paying article. Only useful plants should be grown.

Such a school would in all probability be self-supporting in seven years and have an enormous effect in showing the natives a means of making money, which they would not be slow to take advantage of.

#### INDEX OF NATIVE NAMES.

- Aba. *Landolphia Hendelotii*. Rubber, p. 46.  
 Abba. *Ficus Vogelii*. Rubber, p. 46.  
 Abblé }  
 Abiri } *Zea Mais*, p. 41.  
 Abrus *precatorius*. Med.  
 Acacia spp. Gum. p. 31.  
 African bark. *Crossopteryx Kotschyana*. Med.  
 African bass. *Raphia vinifera*. Fibre, p. 26.  
 African bowstring hemp. *Sansevieria guineensis*. Fibre, p. 25.  
 African flax. See Bowstring hemp.  
 African oak. *Oldfieldia africana*. Timber.  
 African pine, probably Blue Bessi.  
 African rosewood. *Pterocarpus erinaceus*. Timber.  
 Agbado. *Zea mais*, p. 41.  
 Agbari-etu. *Alafia* sp. Fibre.  
 Agbari-etu. *Gomphia reticulata*. Med.  
 Agbassin. See Agbourin.  
 Agbassy. See Egbassy.  
 Agbo, ommodo. *Tabernæmontana barteri*. Med.  
 Agbourin. *Honckenya ficifolia*. Fibre, p. 26.  
 Agusi. *Cucumis melo*. Oil, p. 23.  
 Akawn, ek kun { *Acanthus montanus*. Med.  
                           { *Argemone mexicana*. Med.  
 Akan yunyun. *Ageratum conyzoides*. Med.  
 Akbaha. Med. and Timber. *Ficus Vogelii*? p. 46.  
 Akbata. Timber (? akbaha).  
 Aki. *Blighia sapida*. Fruit.



SIERRA LEONE  
(BOTANY).

- Akirri. *Urena lobata*. Fibre, p. 26.  
 Akoké. *Gærtnera* sp. Med.  
 Akokola. *Cajanus indicus*. Veg., p. 42.  
 Albizzia Brownei. Gum, p. 31.  
 Almond Timber?  
 Aloe spp. Fibres, p. 26.  
 Alum-root. Med.  
 Allspice. *Xylopia æthiopica*. Med.  
 Amaralia bignoniæflora. Med.  
 Ambalima. *Eremospatha Hookeri*.  
 Amelliky. *Sarcocephalus esculentus*. Med.  
 Ankalaki. *Polygala butyracea*. Oil, p. 23.  
 Anthocleista nobilis. Med. No. 4,145.  
 Antoni. Timber.  
 Assoiba. *Dissotis plumosa*. Med.  
 Arnatto. *Bixa orellana*. Dyes, p. 30.  
 Arrowroot. *Maranta arundinacea*. Veg., p. 21.  
 Assarba. *Sideroxylon dulcificum*. Fruit.  
 Atah. *Xanthoxylum horridum*. Med.  
 Atajué, atangmé. *Cyperus esculentus*. Veg.  
 Atorin. *Glyphea grewioides*. Med.  
 Avocado pear. *Persea gratissima*. Fruit.  
 Awaw. *Lankesteria elegans*. Med.  
 Awusa. *Plukenetia conophora*. Veg., p. 42.  
 Baboobone. Timber.  
 Baganro. *Jatropha Curcas* Oil, p. 24.  
 Bambarra. *Voandzeia subterranea*. Veg., p. 23.  
 Bamboo. *Bambusa* sp., p. 36.  
 Bamboopalm. *Raphia vinifera*, *Gærtneri*. Fibre, p. 26.  
 Bambuk. *Butyrospermum Parkii*. Rubber.  
 Banana. *Musa sapientum*. Fruit, p. 26.  
 Bangba. *Lonchocarpus laxiflora*. Med., No. 5,803.  
 Banjange. *Solanum* sp.  
 Baphia pubescens. Timber.  
 Barambarra. *Zanthoxylum* sp., No. 4,962.  
 Barwood. *Baphia nitida*, see p. 30.  
 Basella alba. Veg.  
 Bastard mahogany. Timber.  
 Batjitjor. *Vernonia nigritiana*. Med.  
 Batui. *Pterocarpus esculentus*. Fruit.  
 Baub. *Vitex cienkowskia*, p. 31.  
 Bdelium. *Balsamodendron africanum*. Gum.  
 Beak. *Zea mays*.  
 Bei. *Bauhinia rufescens*. Timber.  
 Béligbélé. *Detarium senegalense*. Fruit.  
 Bellenda. *Crossopteryx kotschyana*. Med.  
 Bembé. *Capsicum annum*, p. 42.  
 Beniseed. *Polygala butyracea*, *Sesamum indicum*. Oil, p. 23.  
 Benten, Bintafora. *Eriodendron aufractuosum*. Fibre.  
 Béraf. *Citrullus vulgaris*. Veg.  
 Béraka soursour. *Mezoneurum Benthamianum*. Med.



- Bitter kola. *Garcinia Kola*. Med.  
 Bitter leaf. *Vernonia amygdalina*. Veg., p. 42.  
 Black mangrove. *Rhizophora* sp. Timber.  
 Blackplum. *Vitex megaphylla*. Med. *Parinarium excelsum*.  
 Black tamarind } *Tamarindus indicus*? Timbers.  
 Black tomblas }  
 Blaw. *Sansevieria guineensis*. Fibre, p. 25.  
*Bloodplum*. *Hæmatostaphys Barteri*. Fruit.  
 Bloodstick. *Haronga paniculata*. Med.  
 Blue Bessi. Timber?  
 Boboi. Rubber?  
 Bocombo. Timber?  
 Bockra. *Dioscorea alata*. Veg., p. 43.  
 Bokboi. *Ipomæa bonanox*, *coccinea*, *selicuspis*. Veg., p. 42.  
 Bolobola. *Honckenya ficifolia*. Fibre, p. 26.  
*Bolombe*. *Macaranga monandra*.  
 Bolongi. *Basella alba*. Veg., p. 42.  
 Bonduc. *Cæsalpinia Bonducella*. Med., p. 23.  
 Bongbo. *Cassia Sieberiana*. Timber. Med., No. 5,071.  
 Bongboisé. *Uvaria chamæ*. Med.  
 Bonté. *Luffa acutangula*. Veg.  
 Bop. Timber?  
 Bopui. Veg. *Ipomæa*, sp.  
 Boré. *Solanum melongena*, p. 42.  
*Bormbor*. *Lippia adœnsis*. Med.  
*Bottle Gourd*. *Lagenaria vulgaris*. Veg.  
*Brassica juncea*. Oil, p. 23.  
 Brimstone. *Morinda citrifolia*. Timber. Med.  
 Brokeback. *Chailletia toxicaria*. Poison, No. 4,408, 5,601A.  
 Buaji. *Spondias lutea*. Gum, p. 32.  
 Buaji. See Jodo.  
 Buji. *Randia maculata* (tatooing).  
 Bukinja. *Dissotis grandiflora*.  
 Bungbo. *Morinda citrifolia*. Med. No. 5,278.  
 Bush cane. *Costus afer*. Med.  
 Bush coffee. *Coffea stenophylla*, p. 15.  
 Bush pepper. *Piper Clusii*. Med.  
 Buté? Veg.  
*Butter and tallow tree*. *Pentadesma butyracea*. Rubber.  
*Caconcia paniculata*. Med.  
 Calabar bean. *Physostigma venenosum*. Poison.  
 Calabash. *Lagenaria vulgaris*.  
 Calabash nutmeg. *Monodora myristica*.  
 Cam wood. *Baphia nitida*. Dye, p. 30.  
 Cane palm. *Calamus Barteri*. See Tambi.  
 Cardamom. *Amomum cardamomum*, p. 20.  
*Carpolobia alba*. Fruit, No. 5,474.  
 Cashew nut. *Anacardium occidentale*. Oil, p. 24.  
 Cassada. *Manihot aipi*. Veg., p. 42.  
 Cassia absus, *alata*, *tora*. Med.  
 Castor oil. *Ricinus communis*. Med., p. 24.



SIERRA LEONE  
(BOTANY).

- Cedar. *Khaya senegalensis*? Timber.  
 Chew stick. *Garcinia Kola*. Toothbrush.  
 Chili. *Capsicum annum*.  
 Christmas bush. *Alchornia cordata*.  
 Cinnamon. *Cinnamomum zeylanicum*, p. 21.  
 Cissampelos pareira. Med.  
 Citron. *Citrus medicus*. Fruit.  
 Clematis grandiflora. Med.  
 Clitandra Barteri. Fruit.  
 Cochlospermum tinctorum. Dye. Med., No. 5,690.  
 Cocoa. *Theobroma cacao*, p. 17.  
 Coco nut. *Cocos nucifera*. Oil, fibre, p. 28.  
*Cocoaplum*. *Chrysobalanus icaco*. Fruit.  
 Coffee. *Coffea liberica* and *C. stenophylla*, p. 15.  
 Comma. Timber?  
 Combo. See Mutugo, p. 21.  
 Congo bean. *Cajanus indicus*. Veg., p. 42.  
 Connarus africanus. Med., No. 5,603.  
 Copal. *Copaifea guibourtiana*? Gum, No. 4,537, ? p. 32.  
 Cork wood. *Musanga Smithii*. Timber.  
 Cotton. *Gossypium barbadense*, pp. 24, 27.  
 Cotton tree. *Eriodendron anfractuosum*. Fibre, oil.  
 Country blue. *Lonchocarpus cyanescens*, *Indigofera anil*,  
*tinctoria*. Dye, pp. 30, 31.  
 Country camwood. *Bixa orellana*. Dye, p. 30.  
 Country grapes. *Vitis cæsia*. Fruit.  
 Country rope. *Vitis urenæloba*. Fibre, p. 28.  
 Cowitch. *Mucuna pruriens*.  
 Crab. *Carapa guyanensis*. Timber, p. 23.  
 Crabs eyes. *Abrus precatorius*. Med.  
 Craterispermum laurinum. Dye, p. 31.  
*Cream fruit*. *Roupellia grata* (unknown at Sierra Leone  
 now).  
 Croton sp. Med., No. 4,429.  
 Cubebs. *Piper clusii*. Med., p. 19.  
 Cucumber. *Cucumis sativus*. Veg., p. 42.  
 Curcas. *Jatropha curcas*. Oil and med., p. 24.  
 Custard apple. *Anona reticulata*. Fruit.  
 Daha?  
 Damson. *Spondias lutea*. Fruit.  
 Dattock. *Detarium senegalense*.  
 Dawi. *Parinarium excelsum*. Fruit.  
 Dialamban. *Dalbergia melanoxylon*. Timber.  
 Dika. *Irvingia Barteri*. Oil, p. 24.  
 Din. *Xylopia parviflora*. Timber.  
 Dité. *Detarium senegalense*. Fruit.  
 Djendjeng. *Dissotis grandiflora*. Wine.  
 Djengé. *Landolphia* sp. Rubber, p. 46.  
 Djuga. *Aubrya gabonensis*. Timber.  
 Doi. *Sarcocephalus esculentus*. Fruit.  
 Dondoi. *Crotalaria intermedia*. Med.



- Doré. *Cassia tora*. Med.  
 Dundaké. *Sarcocephalus esculentus*. Fruit and Med., and  
     *Cochlospermum tinctorium*. Med., see p. 30.  
 Ebony. *Diospyros* sp.? *Dalbergia melanoxylon*?  
 Ebocboat, Ebru. *Zea mais*.  
 Egbassy. *Sarcocephalus esculentus*. Fruit, Med., Timber.  
 Egbubu. *Amomum latifolium*. Med.  
 Egiata. Med.?  
 Egira. *Bridelia micrantha*. Med., No. 4,018.  
 Egirinawdaun, *Ipomæa Nil*. Veg.  
 Ekora. *Cnestis ferruginea*. Med.  
 Ekuya. *Gynandropsis pentaphylla*. Veg., Med., p. 43.  
 Élosizegwé. *Ximenia americana*. Fruit.  
 Élu. *Lonchocarpus cyanescens*. Dye, Med., p. 30.  
 Entada scandens. Med., and Fibre, p. 28.  
 Éra. *Piper Clusii*. Med.  
 Éru. *Xylopiæ Æthiopica*. Med.  
 Erugu. *Uvaria chamæ*. Med.  
 Escho. *Bombax buonopozense*. Med.  
 Eseré. *Physostigma venenosum*. Poison, Med.  
 Étanka. Med.?  
 Etua. *Kigelia africana*. Fetish.  
 Euphorbia pilulifera. Med.  
 Evino. *Vitex cuneata*. Timber.  
 Ewaroudo. *Sparganophorus Vaillantii*. Veg., p. 43.  
 Fanké. *Oxymitra pallens*? Med.  
 Fayar, Feru. *Cochlospermum tinctorium*. Dye, Med., p. 30.  
 Fetfetti. *Lippia adoensis*.  
 Fever plant (Liberia). *Ocimum viride*. Med.  
 Fig. *Ficus* spp., p. 40.  
 Finger-root. *Uvaria chamæ*. Med.  
 Fofoi. *Myrianthus*. Fruit.  
 Folli. *Canna indica*. Veg., p. 43.  
 Fonké.? Used in Djendjeng wine.  
 Frana. *Telfairia pedata*. Oil, Med.  
 Frankincense tree. *Daniella thurifera*. Oil, p. 32.  
 Fundaba. Timber?  
 Fundi, Fundaingay. *Paspalum exile* Cer., p. 41.  
 Furé (the rubber). *Landolphia* sp., p. 46.  
 Furé (the dye). *Grumilea psychotrioides*, p. 31.  
 Galam. *Butyrospermum Parkii*. Rubber.  
 Gambia tea. *Lippia adoensis*.  
 Gamboge tree. *Symphonia globulifera*. Gum.  
 Gardenegg. *Solanum melongena*. Veg.  
 Gawi. *Dioscorea* sp. Veg., p. 43.  
 Gbambé. Timber?  
 Gheck. Timber?  
 Gbeyido. *Xylopiæ polycarpa*. Dye, Med., p. 31.  
 Geawi. *Turræa heterophylla*. Med.  
 Gengeseng. *Carpodinus*. No. 4,924.  
 Genyé. *Carpodinus* sp. nov. Rubber, p. 46.



SIERRA LEONE  
(BOTANY).

- German steel. Timber.  
 Gero (*see* Kus.)  
 Giawui. *Turrea heterophylla* No. 4,751.  
 Ginabui. *Kigelia angolensis* Fetish. No. 4,757.  
 Gingelly. *Sesamum indicum*. Oil, p. 23.  
 Ginger. *Zingiber officinale*, p. 20.  
 Gingerbread plum. *Parinarium macrophyllum*. Fruit.  
 Godawi bawodo. *Aneilema beninense*. Med.  
 Gogo. *Phrynium Beaumetzi*. Med.  
 Goguai. *Amomum latifolium*. Med.  
 Gonaki. *Acacia Adansonii*. Timber.  
 Gongo. *Ficus* sp. Fruit.  
 Gongoi. *Ficus* sp. No. 4,656. Fruit.  
 Gongwé. *Ficus platyphyllum* No. 4,468. Fruit.  
 Gourd. *Cucurbita maxima*. Veg.  
 Grabondo. *Hibiscus esculentus*. Veg. Med.  
 Grewia spp. edible fruit.  
 Grigri. Timber. ? *Avicennia* sp.  
 Groundnut. *Arachis hypogea*. Oil. Veg., p. 22.  
 Guarri. *Cæsalpinia Bonducelli*. Oil, p. 23.  
 Guava. *Psidium pyrifera*. Fruit.  
 Guinea corn. *Panicum maximum*. Cer., p. 41.  
 Gwenudek. *Celastrus senegalensis*. Med.  
*Hæmorrhage Plant.* *Aspilia latifolia*. Med.  
 Haya. *Erythrophleum guineense*. Timber. Poison.  
 Hemp. *Cannabis sativa*. Oil, p. 24.  
 Henna. *Lawsonia alba*. Dye, p. 31.  
 Hog plum. *Spondias lutea*. Gum, p. 32.  
 Hpokpoka. *Tabernæmontana crassa*. Rubber, fibre, p. 28.  
 Hyptis spicigera. Oil, p. 24.  
 Iba. *Irvingia Barteri*. Fruit.  
 Igongo. *Tephrosia Vogellii*. Fish poison.  
 Ijan, *Lepidoturus laxiflorus*. Med.  
 Ikanigbo. *Sabicea calycina*. Med.  
 Ilassa. *Honckenya ficifolia*. Fibre, p. 26.  
 Ile. *Uapaca Heudelotii*. Fruit.  
 Indian shot. *Canna indica*. Veg.  
 Indigo. *Indigofera anil*, *I. tinctoria*, (*see* Élu), p. 31.  
 Iné. *Strophanthus* sp. Poison.  
 Ingiwoya. *Scleria Barteri*. Fibre, p. 28.  
 Inglé. *Corchorus olitorius*. Fibre. No. 5,228, p. 29.  
 Inguli. *Vitex Cienkowski*. Dye, p. 31.  
 Iron post. Timber?  
 Iron wood. Timber?  
 Ishuikbo. *Anchomanes dubius*. Med.  
 Jagwi. *Lawsonia alba*. Dye, p. 31.  
 Jakatu. *Solanum* sp. Veg., p. 43.  
 Jawi. *Trichilia Hendelotii*. Dye, p. 31.  
 Jawki. *Holarrhena africana*. Fibre, p. 29.  
 Jawyun. *Dæmia angolensis*. Med.  
 Jeinjokke. *Cissampelos Pareira*. Med.  
 Jequirity, Jumble beads. *Abrus precatorius*. Med.



- Jiawi. *Turrea heterophylla* Fibre. p. 28.  
 Jodo. *Securidaca longipedunculata*. Fibre, p. 28.  
 Jumblekono. *Napoleona Whitfieldii*. Med. No. 4,299.  
 Jute. *Corchorus olitorius*, *tridens* &c. Fibre, p. 29.  
 Kabundo. *Zanthoxylum* sp. Med.  
 Kafé. *Sideroxylon longistylum*.  
 Kaiyé. *Dioscorea* sp. Med.  
 Kajo. *Eugenia owariensis* (for Djendjeng).  
 Kankan. Timber?  
 Kankéliba. *Combretum altum*. No. 4,753.  
 Kantingi. *Anisophyllea laurina*. Timber.  
 Kanya. *Pentadesma butyracea*. Rubber, p. 25.  
 Kapok. *Eriodendron anfractuosum*. Fibre, p. 29.  
 Karamui. *Luffa acutangula*. No. 4,641. Veg., p. 24.  
 Karott. Timber?  
 Karri. Timber?  
 Katé. *Combretum glutinosum*. Timber.  
 Katéma. Timber.  
 Katémfé. *Phrynium Danielli*. Fruit.  
 Katulonga. *Gærtnera? paniculata*. Timber.  
 Kbanala. *Alsodeia ilicifolia*. No. 4,427. Med.  
 Kbandé. *Erythrophleum guineense*. Timber. Poison.  
 Kbondoi. *Eranthemum* sp. Med. No. 4,428.  
 Kelabu, Kalabo. *Salacia pyriformis*. Timber.  
 Kélé. *Raphia Gærtneri*. Fibre, p. 26.  
 Kennedy fig. *Ficus* sp. Med.  
 Keré. *Cassia occidentalis*. Fruit, p. 17.  
 Kéwé. *Xylopia æthiopica*, *Garcinia ovalifolia*. Med.  
 Kewer. *Sapindus senegalensis*. Timber.  
 Kindi. *Physalis minima*. Veg., p. 43.  
 Kino. *Pterocarpus erinaceus*. Timber.  
 Kitanga. *Eugenia Michelini*. Fruit.  
 Klélé. *Mezoneuron Benthamianum*. Med.  
 Kobé. *Sterculia tragacantha*. Gum. No. 4,465, p. 32.  
     obérafaira. *Vernonia firma*. Med.  
     obo. *Copaifera Guibourtiana*. Gum, p. 32.  
 Kobodigansu. *Mitragyne macrophylla* (leaves for packing  
     Cola). No. 4,752.  
 Koboi 4,537. *Cryptosepalum tetraphyllum?* p. 32.  
 Kobotué. Timber?  
 Kocyto. *Dialium guineense*. Fruit.  
 Koé. *Chytranthus* sp. Poison.  
 Kofé. *Garcinia Kola*, also *Solanum* sp., p. 43.  
 Kokan. Timber?  
 Koko. *Colocasia antiquorum*. Veg., p. 43.  
 Kokondui. Med.?  
 Kola. *Kola acuminata*, p. 18.  
 Kolikola. *Pteris atrovirens* 4,747. Med.  
 Komasimi. *Piper Clusii*.  
 Kombo. *Myristica angolensis*. Oil.  
 Komboboya. *Oxymitra pallens?* Med.  
 Konkon. Timber?



SIERRA LEONE  
(BOTANY).

- Konta. *Berlinia auriculata* ?  
 Kontakobong. Timber.  
 Koti. *Sorghum vulgare*. Cer., p. 42.  
 Kraw Kraw Medicine. *Oethulia conyzoides*. Med.  
 Krin Krin. *Amomum melequetta*. Med.  
 Kronko. *Griffonia pallescens* var *arborescens*. Timber.  
 Krukari. Kurukari. Med. (fingerroot ?).  
 Kuji. *Solanum Naumannii*. Veg., p. 43.  
 Kuka. *Adansonia digitata*. Fruit, p. 29.  
 Kukomboya. *Sterculia cinerea*. Timber. Fibre, p. 29.  
 Kukwi. *Kola digitata*. No. 4,327. Potash, p. 43.  
 Kumbulu. *Amomum palustre*. Med.  
 Kundi. *Carapa guyanensis* ? Timber. Med.  
 Kunyakumé. *Ochna* sp. Fruit. No. 5,350.  
 Kurunk or Kronko. Timber ?  
 Kus. *Pennisetum typhoideum*. Cereal, p. 42.  
 Kushumin. *Carpodinus* sp. Med.  
 Kwia. *Amaralia bignoniæflora*. Med.  
 Kwiajupong. *Vernonia Perrottetii*. Veg.  
 Lagos Bologi. *Talinum crassifolium*. Veg., p. 43.  
 Laintlaintain. *Lophira alata*. Oil, p. 24.  
 Lalepunt. Med. ?  
 Lemongrass. *Andropogon schoenanthus*. Med.  
 Lime. *Citrus medicus*. Fruit, p. 39.  
 Lindi. *Combretum nigricans* (djendjeng winé). No. 4,963.  
 Locust. *Parkia biglobosa*. Med. ? p. 40.  
 Lotoòdo. *Hæmanthus abyssinicus*. Med.  
 Lufa. *Luffa Ægyptiaca*. Veg., p. 24.  
 Mabubu. *Amomum latifolium*. Med.  
 Makant. Timber ?  
 Malaquetta pepper. *Amomum Malaquette*, A. grana  
 paradisiacas. Med., p. 20.  
 Maluka. *Polygala butyracea* (? *rarifolia*). Oil.  
 Mammi apple. *Ochrocarpus africanus*. Timber.  
 Manbodi. *Detarium senegalense*. Fruit.  
 Mango. *Mangifera indica*. Fruit, p. 38.  
 Mangrove. *Rhizophora mucronata*. Tanning.  
 Mangrove, Red. *Rhizophora racemosa*. Dye, Tanning, p. 31.  
 Maquiqui. *Homalium angustifolium*. Fruit.  
 Mawkai. *Dialium guineense*. Fruit.  
 Mbilorr. *Herminiera elaphroxylon*. Timber.  
 Mbirr. *Sclerocarya Barteri*. Fruit.  
 Mbungo. *Landolphia florida*. Rubber.  
 Mékingi. *Crossopteryx Kotschyana*. Med.  
 Melon. *Cucumis melo*. Veg.  
 Mémé. *Chailletia toxicaria*. Poison.  
 Meni. *Lophira alata*. Oil. No. 4,644, p. 24.  
 Milkwood. Timber ?  
 Millai. See Meni.  
 Millet. *Panicum maximum*. Cereal, p. 24.  
 Mobola, mola. *Parinarium mobola*. Fruit.



- Mongmoi. *Symmeria paniculata*.  
 Monkey apple. *Trichilia Prienriana*. Fruit. *Anisophyllea* (BOTANY).  
 laurina. Fruit and Timber, p. 40.  
 Monkey bread. *Adansonia digitata*. Fruit and Med., pp. 29, 40.  
 Monkey Guava. *Diospyros mespiliformis*. Fruit.  
 Morelia senegalensis. Fish poison.  
 Mossa amquano. *Amomum escapum*. Med.  
 Mpano. *Baphia pubescens*. Dye.  
 Mpofu, Mubafo. *Canarium edule*. Fruit, p. 24.  
 Mpoga. *Parinarium*? Oil, p. 25.  
 Mualaba. *Maba mualaba*. Fruit.  
 Musolveira. *Diospyros platyphylla*. Fruit.  
 Musyabassa. *Plukenetia conophora*. Veg., p. 43.  
 Mutugo. *Myristica Angolensis*.  
 Nadi. *Parkia biglobosa*. Fruit. No. 4,771, p. 40.  
 Nandé. *Dichroostachys platycarpa*. Hedges.  
 Ndahi. *Ficus trachyphylla* and other *Ficus* sorts. No. 4,298.  
 Ndawi. *Triclisia macrophylla*. Fruit.  
 Ndimb. *Sterculia cordifolia*. Fibre.  
 Ndomi. *Palisota thyrsiflora*. Hedges.  
 Neté. *Parkia biglobosa*. Fruit, p. 40.  
 Neverdie. *Kalanchoe brasiliensis*. Med.  
 Ngakownli. *Melastomac*. Med.  
 Ngepassa. *Lonchocarpus cyanescens*. Dye. No. 4,786,  
 5,284, p. 30.  
 Ngéwa. *Ceratopteris thalictroides*. Med.  
 Ngingwi. *Bauhinia reticulata*. Timber.  
 Nialé. See ngepassa.  
 Niawé niawé. *Kola Afzelii*. Potash.  
 Nigerseed. *Guizotia abyssinica*. Oil.  
 Niko. See Mpogo.  
 Niowé. *Myristica longifolia*. Oil.  
 Nutmeg. *Myristica moschata*, p. 21.  
 Oba. *Sterculia tragacantha* (*Irvingia Barteri*), p. 32.  
 Obai. *Haronga paniculata*. Timber.  
 Obro. *Amomum* spp. Med.  
 Ochra, ochro, okra. *Hibiscus abelmoschus* (*also esculentus*?).  
 Veg., pp. 29, 43.  
 Odum. *Chloroflora excelsa*. Timber.  
 Odjendé. *Pentadesma butyracea*, p. 25.  
 Ogaguma. *Tetrapleura Thonningii*. Med., p. 25.  
 Oganí. *Ficus* sp.  
 Ogeagam. *Daniella thurifera*. Gum, p. 32.  
 Ogiologbo. *Morinda longiflora*. Med. Nos. 4,186, 5,826.  
 Okka kpupan. *Sorghum vulgare*, p. 31.  
 Okpweigo. *Cyrtosperma* sp. Med.  
 Okwa. *Treculia africana*. Fruit.  
 Ondi. *Amaranthus patulus*. Veg.  
 Onia. *Eriodendron anfractuosum*. Fibre, p. 29.  
 Opachala, owala. *Pentaclethra macrophylla*. Oil, p. 25.  
 Orange. *Citrus aurantium*, p. 39.



SIERRA LEONE  
(BOTANY).

- Oro. *Euphorbia* sp. nov. Poison.  
 Oro. *Landolphia owariensis*. Rubber, p. 46.  
 Oshékpotufunfun. *Sida carpinifolia*. Med.  
 Oshunshun. *Carpolobia lutea*. Med.  
 Ossani. *Lonchocarpus sericens*. Timber.  
 Otimbalilo. *Omphalocarpum procerum*.  
 Palms. *Elæis guineensis*. Oil, p. 22.  
 Papengé. *Luffa acutangula*. Veg., p. 24.  
 Paw. Timber?  
 Peachroot. *Sarcocephalus esculentus*. Fruit. Med.  
 Pepper. *Capsicum annum* (Chili).  
 Pepper black. *Piper nigrum*, p. 19.  
 Piassava. *Raphia vinifera*. Fibre, p. 26.  
 Pineapple. *Ananas sativa*. Fruit, pp. 29, 39.  
 Platycerium *Æthiopicum*. Med. No. 4,103.  
 Pomegranate. *Punica granatum*. Fruit.  
 Pishamin. *Carpodinus dulcis*. Fruit.  
 Pipybras. *Scoparia dulcis*. Med. No. 5,869.  
 Poní. *Newbouldia lævis*? Med.  
 Popondé. *Piper umbellatum*. Veg. No. 4,287, p. 43.  
 Popow. *Carica papaya*. Fruit. Med., p. 28.  
 Potherb. *Portulaca oleracea*. Veg.  
 Pumpkin. *Cucurbita pepo*. Veg.  
 Quinjé. *Ophiccaulon cissampeloides*. Varnish, p. 32.  
 Rawodué. *Celosia argentea*. Veg.  
 Rice. *Oryza sativa*. Cereal, p. 41.  
 Roko, iroko. *Chlorophora excelsa*. Timber.  
 Roseapple. *Eugenia* sp. Fruit.  
 Roughskin Plum. *Parinarium excelsum*. Fruit.  
 Rourea *santaloides*. Fibre and Med.  
 Rubber. *Landolphia owariensis*, florida. *Carpodinus*.  
 " *Ficus Vogelii* and *F.* sp. see p. 44.  
 Sabicea *Vogelii*. Med.  
 Sabral. *Sesbania punctata*. Timber.  
 Sansieviera *guineensis* fibre, p. 25.  
 Sandpaper. *Ficus asperifolia* and *F. exasperata*.  
 Santang. *Daniella thurifera*. Rubber.  
 Sapodillo. *Sapota Achras*. Fruit.  
 Sarilo? Med.  
 Sassy. *Erythrophleum guineense*. Poison. Med. Timber.  
 Sawai. *Clausena anisata*. Med., p. 43.  
 Schmidelia *africana*. Med.  
 Securidaca *longe—pedunculata*. Fibre.  
 Senna. *Cassia obovata*. Med.  
 Sesame. *Sesamum indicum*, p. 23.  
 Shagiré. Med.?  
 Shahjo. *Adansonia digitata*. Fruit, p. 29.  
 Shako. Med.?  
 Shalott. *Allium ascalonicum*. Veg., p. 43.  
 Shango. *Oncoba spinosa*.  
 Shawa tomblas? Med.



- Sheabutter. *Butyrospermum Parkii*. Rubber, p. 47.  
 Siboru. *Ficus populifolia*. Med.  
 Sibukolono. *Borassus flabelliformis*. Palm.  
 Sida rhombifolia. Fibre.  
 Siegesbeckia orientalis. Med.  
 Sierra Leone copal. *Copaifera Guibourtiana*. Gum.  
 Silk tree cotton. *Eriodendron aufractuosum*. Fibre, p. 29.  
 Silliment. Med.?  
 Simé. Timber?  
 Sogwé. *Pentadesma butyracea*. Oil, p. 25.  
 Solum. *Dialium guineense*. Fruit.  
 Soursour. *Hibiscus sabdariffa*. Veg. No. 4,173, p. 42.  
 Spice. *Xylopia æthiopica*. Timber.  
 Strangerpalm. See Sibuk.  
 Strophanthus. *S. hispidus*, *S. sarmentosus*, &c. Med.  
 No. 5,300.  
 Subaltern's butter. *Persea gratissima*. Fruit.  
 Sugarcane. *Saccharum officinale*, p. 20.  
 Sunhemp. *Mimosa asperata*. Fibre.  
 Sweet potatoe. *Ipomœa batatas*. Veg., p. 43.  
 Sweetsop, soursop. *Anona squamosa*, *reticulata*. Fruits.  
 Symphonia globulifera. Gum, p. 32.  
 Tagiri. *Luffa cylindrica*. Veg., p. 24.  
 Tallicoma. *Carapa guyanensis*. Timber.  
 Tam. *Sideroxylon dulcificum*. Fruit.  
 Tamarind. *Tamarindus indicus*. Fruit, p. 40.  
 Tambi. *Calamus Barteri*. Canes, ropes. No. 4,738, p. 28.  
 Tarbar. *Celosia argentea*. Veg.  
 Tassin. *Solanum* sp. Veg. No. 4,763, p. 43.  
 Tawi. *Dolichos Lablab*, *Eriosema cajanoi*des. Veg. Phaseolus mungo.  
 Tawi. *Tephrosia Vogelii*. Fish poison. No. 3989.  
 Tchioge. *Spathodea campanulata*.  
 Telimi. *Erythrina senegalensis*. Med. No. 4,516.  
 Téma. Timber?  
 Tengbu. *Trema guineensis*. Med. No. 4,974A.  
 Terminalia spp. Timber trees.  
 Tettitetti. *Cassia alata*. Med.  
 Threeleaf. *Schmidelia africana*. Med. No. 5658.  
 Tigernut. *Cyperus esculentus*. Veg., p. 43.  
 Til. *Sesamum indicum*. Oil.  
 Tobacco. *Nicotiana tabacum*, p. 21.  
 Toja. *Urena lobata*. Fibre, p. 26.  
 Tolmga. *Morinda citrifolia*. Med.  
 Tomato. *Lycopersicum esculentum*. Veg., p. 43.  
 Tonke. *Hippocratea* sp. 4,965. Wine.  
 Toothbrush. *Garcinia kola*. Root.  
 Tora, Tula. *Ochrocarpus africanus*? Timber and fruit.  
 Toto. *Aristolochia* sp. Med.  
 Toto. *Hugonia Planchoni* (vide Mr. Millson).  
 Tragacanth. *Sterculia tragacantha*. Gum.



SIERRA LEONE  
(BOTANY).

- Ukott.* *Raphia Hookeri*.  
*Vanilla.* *Vanilla planifolium*, p. 19.  
*Velvet leaf.* *Pareira Brava.* Med.  
*Velvet tamarind.* *Dialium guineense.* Fruit, p. 40.  
*Wakwangé.* *Tacazzea Welwitschii.* Med.  
*Water melon.* *Citrullus vulgaris.* Oil, p. 25.  
*Water oak.* Timber?  
*Water tree.* *Tetracera alnifolia.*  
*Wattle.* Timber?  
*Ween.* *Pterocarpus* sp.  
*Wild coffee.* *Coffea stenophylla.*  
*Wild guava.* *Psidium pyrifera.* Fruit.  
*Wild mango.* *Irvingia Barteri.* Fruit.  
*Wissmore.* Timber?  
*Woman Brimstone.* *Uvaria Chamæ.* Med.  
*Wuacruli.* *Sarcocephalus esculentus.* Med.  
*Xmasbush.* *Alchornia cordata.* Med. No. 4,179.  
*Yagalé.* Timber?  
*Yagba.* *Lissochilus roseus.*  
*Yahhop.* *Xysmalobium Heudelotianum.* Veg.  
*Yakoli.* *Euadenia eminens.* Med.  
*Yam.* *Dioscorea* spp. Veg., p. 43.  
*Yangkompno.* *Senecio Tedliei.* Med.  
*Yellow dye shrub.* *Craterispermum laurinum.*  
*Yé ré??* *Piper Clusii.* Med.  
*Yetta.* *Ophiocaulon cissampeloides.* Varnish, p. 32.



REPORT ON THE ROCKS COLLECTED IN  
WEST AFRICASIERRA LEONE  
(GEOLOGY).

BY

G. F. SCOTT ELLIOT, Esq.

Examined at University College, London.

The geological specimens collected by Mr. Scott Elliot on his expedition in Western Africa were sent by him to University College, where some rocks which he had obtained from Egypt in the previous year had been examined. By the kindness of Professor Bonney I was allowed to undertake the description of the West African specimens, and I have to thank him for much help which I received while carrying on the work under his supervision.

I.—*Kambia Section from 0 to 500 feet altitude. Scarcies River.*

In the first part of the journey, from near Kambia along the Scarcies River, at levels below 500 feet, two specimens of gneissose rocks were obtained. The coarser of these appear to have been originally a biotite granite, probably modified by pressure. The other example is fine-grained and finely laminated; the mass extends across the river at Kambia about the level of the sea, giving rise to "a small waterfall or rapid." Rocks which are clearly igneous are exposed in the bed of the river near the same place, two being hornblendic diorites. A well-preserved dolerite containing serpentinised crystals which are probably olivine, was found "at Mofari, further up the river," and is described as "dipping west by north although apparently igneous." This structure might be exhibited by an intrusive sill, or by an interbedded lava, and the lithological nature does not decide the question. The sedimentary rocks exposed on the lower course of the river, two miles north of Sasseni, consist of a quartz-felspar grit or arkose, which includes fragments of gneisses and schists, and contains sometimes well-rounded fairly large pebbles. It resembles rather closely the basement of the Welsh Cambrian series, or the Scotch Torridonian, and like these is largely derived from the denudation of ancient rocks. Although little trust can be placed in a lithological resemblance between distant localities, the Sasseni grit very properly belongs to an old Palæozoic—or it might be a very late Archæan—formation. The pebbles appear to occur along certain bands in the grit and often consist of vein specimens of quartz, or quartz and felspar. A quartz schist, modified by pressure in a way that is difficult to explain, was probably a pebble within a similar band. Two specimens of the ferruginous "pan" or so-called "laterite"

1.

4.

5. 6.

10.

11. 13. 14. 22.

15. 16. 17. 18.

19. 20. 21.

2. 9.



SIERRA LEONE (GEOLOGY). which is very characteristic of the district, have been collected, one from Kambia rich in hæmatite partly crystallised.

## II.—*Kofu Mountain, lat. cir. 9'' 20' N.*

The whole of the lower part of the mountain, from a height of 500 up to 3,200 feet, is described by Mr. Scott Elliot as consisting of gneissose rock. This is capped above by horizontally stratified sandstones 800 feet thick, forming an elevated table-like plateau. Among the lower crystalline series, a fine-grained dolerite occurs, doubtless intrusive. The foliated rocks are probably of igneous origin, one a hornblendic gneiss which has undergone crushing, the other granitoid, now a biotite gneiss. The sedimentary formation which caps the hill, consists of a ferruginous quartz sandstone or pebbly grit, and is interesting as exhibiting a mass of undisturbed horizontal strata at a great elevation. Lithologically it resembles the extensive Nubian sandstones of the East, but it is impossible to say with certainty whether it belongs to the same age.

## III.—*Upper Scarcies Section, 500 to 2,000 feet.*

The rocks of Mount Jambi Buya-buya (1,700 to 2,100 feet) are fine grained dolerites or basalts, and we are told that the "weathering" is "in rounded oblong blocks," as is usual in such masses. A specimen from a lower level (500 to 1,500 feet) seems to be a very compact diabase, and is doubtless from near an edge or junction. The dolerites are fine-grained, ophitic in structure, and one example contains a ferruginous olivine. Similar rocks form the long ridge (800 feet) ending at Wallia; and the masses exposed in the bed of the Scarcies River at that place are possibly allied, although more compact, consisting of dull purplish and green rocks, rather like certain examples of old diabase from Wales.

Associated with these is a small specimen which appears to be an argillite somewhat indurated. The sedimentary series is best represented by brownish quartzo-felspathic sandstones, the strike of which appears from the description to be transverse to the Kora River, the strata crossing the bed of the stream near Wallia projecting in "ridges about 2 feet broad."

## IV.—*Talla Plateau, 2,000–3,500 feet. Latitude 10°.*

In climbing the mountain of Gonkwi from Duunia, the "fallen blocks" first passed at lower levels consist of quartzo-felspathic sandstones and mudstones, sometimes laminated and false-bedded. Above this part rises an abrupt cliff of dolerite, 400 feet high, and similar rock is stated to be almost continuous for 20 or 30 miles along the top of the plateau. One variety, a serpentinised enstatite dolerite, forms the summit of the Gonkivi mountain (altitude 3,000 feet), and beneath it are compact, dark, sometimes slightly speckled rocks, which are apparently sedimentary, exhibiting an early stage of contact alteration. A



similar structure is shown in one specimen from the "horizontally stratified" argillite, forming a cliff 100 feet high at Bolowallia, while other bands are well marked quartz felspar grits. A fine-grained, pale brownish granite with some dark mica, weathering to "rounded lumpy masses," occurs in a stream just below Sumberaya, 2,400 feet. The dolerite on the side towards Sikuru is a fine-grained variety, and forms one of the rocks of which the mountain is said to be composed. A biotite granite with slight foliation was obtained from the same direction; while a coarse red granite is found "in the streams at the base of the plateau at Sikuru, altitude 1,000 feet."

Thus quartzo-felspathic grits and argillites and basic igneous rocks form most of the Gonkwi mountain, with some granite on the Sikuru side. Certain of the argillites exhibit an early stage of contact alteration, apparently caused by the neighbourhood of the dolerite. Other specimens exhibit an induration which is probably due to long continued micro-mineralogical change, and thus they resemble sedimentary rocks of early Palæozoic, or even slightly older date; but the lithological character is not sufficient evidence to prove the geological age. Quartz-felspar grits obtained from certain of these localities bear some resemblance to the strata at Kofiu, but no safe inference can be drawn as to their geological position or that of the somewhat similar rocks at Wallia.

V.—*Kundita and Falaba, alt. cir. 3,500 feet, lat. 10°.*

These specimens are crystalline rocks and are mostly granitoid, generally micaceous, exhibiting more or less foliation. Even the well-marked gneisses are probably of igneous origin. One such rock forms "numerous dome-shaped hills about Falaba," and a similar example was brought from the Plateau of Kundita and Cassa (3,500 feet). Mica, generally biotite, is abundant, and is doubtless the mineral which is said to be "very common" and to form "a glittering dust in the streams." The third constituent sometimes is hornblende, but it consists of amblystegite in a hyperstheniferous diorite or norite, and possibly also in one granitoid rock.

VI.—*Falaba to Bumban, 3,500 feet to 1,000 feet. Return Journey.*

On the return journey, specimens were collected of foliated crystalline rocks, which evidently have undergone crushing. A mica schist was obtained at Bentembu, and gneisses and a typical mylonite are among the specimens which came chiefly from Bumban. Others are igneous rocks, including a compact dolerite and a fine grained mica syenite or diorite. A rock very rich in magnetite, and an iron ore brought from Sierra Leone for analysis are igneous and holocrystalline, belonging to the dolerite group. The latter specimen mainly consists of pinite and iron oxide, with the remains of what appears to be a pyroxene; the former includes a dichroic mineral resembling amblystegite.

SIERRA LEONE  
(GEOLOGY).

55.

56. 58.

59.

67. 68.

66.

64.

61. 63. 55.

44. 48.

46. 47. 49. 56.

40. 42.

75. 83. 73. 70.  
71. 76.

77. 82.

77. 78.

76.

72.

74.

89.

92. 93. 94.  
95. 96. 91.

97. 101.



SIERRA LEONE  
(GEOLOGY).

Iron oxide appears to be the only product of economic importance shown in the specimens, and as I have just pointed out, it is sometimes formed as a pseudomorph within an igneous rock. In other examples, as has been frequently noted, it is deposited as a cement in sandstone, or within the weathered crust formed over the surface of exposed crystalline rock. It is however often in much too small a quantity to be worked, even if it is not too local and limited.

43.

A hone stone brought from Gonkwi is interesting as consisting of a fine-grained dolerite, since a compact sedimentary rock more generally yields the stones used for this purpose.

*Summary.*

We can gather some general idea of the geology of the country from the collection of specimens, although further details are needed to fix their stratigraphical position and relations. It is interesting to notice the lithological similarity between this series of rocks and those which occur in the better known region of Eastern Africa, suggesting that uniform conditions possibly prevailed generally over the continent at early periods. The correspondence is shown, not only in the sedimentary strata, but also in the general character of many of the igneous rocks, dolerites and others.

The crystalline more or less foliated rocks appear to be widespread, occurring as previously described at places some distance apart. Mr. Scott Elliot states that at levels below 1,000 feet "the gneiss or granite may be seen in any deep and narrow river valley, and appears to be the underlying rock everywhere" below the surface covering. Many of the foliated rocks are almost certainly igneous, but among them, some at least resemble those gneissoid and granitoid masses, which in various localities form a fundamental series of very ancient date. Certain examples of schists and mylonites afford evidence of the action of pressure.

Of the sedimentary rocks, the strong pebbly grit or arkose found north of Sasseni resembles, as already stated, an early Palæozoic or slightly older formation. Other deposits, in their even horizontal stratification and in their lithological character, seem to correspond with those distributed over the country further east. The ferruginous quartz sandstone from Kofu, which overlies gneissose rock, is most like some varieties of the well-known Nubian sandstone of North-eastern Africa. Quartz felspar grits which might belong to the same series, although they are somewhat different in character, occur at Wallia and at the Gonkwi mountain; and also some rather indurated argillites are found.

The normal igneous rocks occasionally include coarse granites, but are mostly of a more basic character. As far as we can judge from the localities whence the specimens were obtained, some dolerites are very possibly intrusive in the older crystalline series. At other places, sedimentary rocks have been altered by



contact of igneous masses. The fine-grained dolerites might possibly represent lavas, but their structure would agree equally well with that of intrusive dykes or masses, and the question could only be decided by examination in the field. From the description given by Mr. Scott Elliot, the igneous rocks seem to extend over wide areas, forming, for example, "a capping to the table land of the Talla Hills almost continuous for 20 or 30 miles."

SIERRA LEONE  
(GEOLOGY).

The ferruginous rock, which is apparently widespread, is probably similar to that which has been noticed from many tropical districts of Africa and India. It is sometimes described as "laterite," or as a "formation similar to laterite," (2) but comes nearer to the "iron pan" familiar in more northern regions, except that, owing to different climatic conditions, it is formed at or near the surface. The iron oxide is deposited as a cement binding together grains generally of quartz. The materials might belong to a sandstone (often derived by previous denudation from granitoid rock) or might be the weathered surface débris of crystalline rock in situ. The latter seems a probable origin for some of the specimens, as suggested by Mr. Scott Elliot, since the exposures are found over so large an extent of country with the crystalline rock at a small depth below. The materials, when examined under the microscope, exhibit quartz and fresh looking felspar, often angular, such as would be derived by decomposition of granite or gneiss. A similar "pan" or "laterite" is stated to occur at Gonkwi; and it is quite possible that if this was a surface deposit over a dolerite country, it might be formed by decomposition of that rock. Other specimens appear to be hardened and ferruginous sandstone.

The specimens accordingly may be grouped under the following heads:—

1. Foliated rocks, mostly igneous, probably ancient; and granites containing biotite, or hornblende, and resembling examples of the gneiss, *e.g.*, Kambia, 1, 4; Kofiu, 23, 24; Kundita and Falaba, 70, 71, 76 to 82; Sikuru, 66; Kundita and Falaba, 75.

2. Foliated rocks exhibiting results of crushing, *e.g.*, Kambia, 4, 21; Falaba to Bumban, 89, 94.

3. Normal igneous rocks, granites, *e.g.*, Sikuru, 59, 64, 66; Kundita to Kambe, 73.

4. Other igneous rocks, mainly dolerites, varying in compactness. In these enstatite, olivine, hypersthene are occasionally present, *e.g.*, Kambia, 5, 6, 10; Kofiu, 25; Upper Scarcies, 30, 31; Talla Plateau, 51, 54, 60, 67, 68; Kundita and Falaba, 72; Falaba to Bumban, 95, 96.

With these will be classed certain rocks containing iron oxide, magnetite, and hæmatite, 97, 101.

5. Grits, resembling some of Cambrian age; *e.g.*, north of Sasseni, 11, 14, 22.

6. Quartz sandstones, sometimes ferruginous, lithologically resembling the Nubian sandstone, *e.g.*, Kofiu, 28, 29.



SIERRA LEONE  
(GEOLOGY).

7. Brownish quartz felspar grits and muddy layers, possibly belonging to one of the preceding types, Talla Plateau, 46-49, 56-58; Upper Scarcies, 40-42.

Igneous rock appear to be associated, and some specimens exhibit slight results of contact alteration, *e.g.*, Talla Plateau, 55, 61, 63.

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## PART II.

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### LIST AND DESCRIPTIONS OF SPECIMENS FROM WEST AFRICA.

(1892.)

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#### I.—*Kambia Section from 0 to 500 feet altitude. Scarcies River.*

1. [Granitoid rock exposed in bed of a river flowing into the Mellacori, near Fransiga, on road from Luseniya to Kambia, about 300 feet altitude.]\*

A gneiss somewhat indistinctly banded, consisting of quartz, reddish or brownish felspar, white felspar (in well-formed squarish prisms), which is probably orthoclase and black mica. The last named mineral is crowded at parts, giving sometimes an appearance of segregation. Very small ill-formed garnets, of a ruby colour, are scattered through the rock. It is apparently a gneissoid biotite granite.

2. [Typical rock or "laterite" of the neighbourhood. On the road, about three miles from Fransiga.]

A strong brown iron "pan." A matrix of hæmatite and limonite; contains small grains, mostly sub-angular and almost all of quartz, which might be constituents of a grit, or the weathered materials derived from an underlying granitoid or gneissoid rock.

3. [Quartz, about 600 feet altitude, same place as last.]  
Colourless quartz, doubtless from a vein.

4. [Rock from Kambia, about level of sea, exposed in the bed of the Scarcies river, forming a small waterfall or rapid.]

A fine-grained whitish gneiss, with narrow laminae, consisting of quartz, felspar, and of black mica in minute flakes very evenly disseminated through the rock.

It is interesting to note the crystalline series occurring at sea level.

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\* The descriptions within square brackets are copied from notes given by Mr. Scott Elliot.



[5, 6, 7. Rocks exposed in the bed of the great Scarcies river near Kambia, dipping at about 60°.]

The dip, which is described as a character of these three rocks, might possibly result from their occurrence as parallel dykes or sills, since they are all of igneous nature.

5. This specimen is a diorite or quartz diorite, with very slight tendency to lamination. It is black and white, with some brown ferruginous staining. Hornblende is abundant and well formed, black in the hand specimen, of an umber brown under the microscope. Quartz occurs with the felspar, but not abundantly. Some small microscopic crystals appear to be zircon.

5. A similar specimen, in which red iron oxide can be recognised under the microscope as a thin film or surface deposit on some of the grains and crystals.

7. A small thin specimen of a fine-grained granitoid rock consisting of quartz, felspar, biotite, and small grains of iron oxide, some at least being magnetite.

8. [Specimen brought by a native, Kambia.]

Fragment of clear transparent quartz or rock crystal.

9. [Near Kambia.]

Ferruginous quartz grit. The quartz grains are small and angular, cemented by hæmatite, which is partly a well crystallised deposit, partly forms a glazing on the grains; while some of the iron oxide is weathered to limonite.

10. [Rock found at Mofari, further up Scarcies river, dipping West by North, but apparently igneous.]

(Microscopic.) A compact black rock, with glittering specks, which appear to be micro-porphyrific crystals.

(Microscopic.) The ground mass exhibits an ophitic arrangement. The felspars are narrow and long, very clear, and with plagioclase striping; the augite is in short broadish prisms, with corners somewhat rounded, gummy looking, and slightly tinged. Magnetite occurs in small crystal sometimes as needles or bars.

Pseudomorphs from the alteration of the same or of two very closely allied minerals occur, as brownish green serpentinous aggregates, and as a filmy green substance. The crystals were, doubtless, originally a ferro-magnesian silicate, and probably olivine, although a somewhat abnormal variety. The slide is not very unlike that of the dolerite of Tideswell Dale.\*

A glomero-porphyrific character is given to the rock by groups of felspar crystals. Aggregates of augite and felspar below the average size also interrupt the ground mass.

A fine grained ophitic dolerite, with serpentinous pseudomorphs, and containing porphyritic groups.

The next specimens consist of grits, which resemble such rocks as those of the Torridon series of Scotland. The vein quartz (12,16-20,22) of some examples, and probably of all from this

\* Brit. Petr. Pl. IX., Fig. 1.



SIERRA LEONE  
(GEOLOGY).

locality, formed pebbles contained within the grit, fragments of which adhere on several.

11. [Typical specimen of rock weathered to a rounded mass, exposed in bed of Scarcies river, about two miles north of Sasseni.]

A quartz felspar grit or arkose, which shows faint indications of broadish bands; the redder are rather coarser, containing much red felspar or fragments of granitoid rock, the greenish darker are finer grained. The grit includes:—(1) A pebble, about 2 inches long, of a pale coloured fine granitoid rock with some green chlorite; (2) a small red granitoid pebble; (3) one or more small pebbles of greenish quartzite; (4) one of small size, consisting of quartz stained red by iron oxide.

The ground mass of the grit consists of quartz, red felspar, white mica, green chlorite, or mica and viridite, with flecks of hæmatite or limonite.

The well rounded pebbles must have been formed by the action of shore waves, or by fairly long river transport, and the deposit very probably was not newer than some early Palæozoic formation, judging from lithological character.

12. [Rock exposed in Scarcies river, 2 miles north of Sasseni.]

This specimen has some likeness to a granitoid rock, but it seems to be from a quartz felspar vein, the quartz forming wavy streaks, which weather out as ridges on one surfaces. A fragment of reddish grit like (11) adheres at one corner, and the specimen is probably from an included pebble.

13. [Close grained brown rock from Scarcies river, two miles north of Sasseni. Not common.]

A fine grained dark reddish grit. The dull red colour seems to be mainly due to a fine deposit or staining of iron oxide. The grains consist of reddish felspar, quartz, some black iron oxide, and a few green flecks, probably chloritic. The constituents are thus very similar to those of the pebble grit (11).

14. [A part of massive rounded rocks, from River Scarcies, two miles north of Sasseni.]

A reddish quartz felspar grit, consisting of grains, angular or sub-angular, occasionally rounded, averaging about  $\frac{1}{8}$ th to  $\frac{1}{16}$ th inch, with one or two half-inch pebbles.

(Microscopic). The constituents are:—(1) felspar, much of which is plagioclase and decomposed, but not a few crystals are microcline, and these are sometimes clear and fresh; (2) quartz, in which strain shadows are well marked; (3) fragments of quartz-schist or mica-schist; (4) feldspathic grit or finer clastic rock occasionally; (5) felstone; and (6) a chloritic mineral.

The fragments, apparently, were largely derived from ancient granitoid or gneissoid masses; and the grit probably belongs to an old series. It is a quartz-felspar grit, containing fragments of schist.



[15, 16, 17, 18, 19, 20. Quartzose fragments found as small rounded pebbles in belts in (11) exposed at the Scarcies river, two miles north of Sasseni.]

15. Pebble like a granitoid rock, very probably from a vein stained with reddish hæmatite, doubtless from a grit (like 11), of which a small fragment adheres.

16. Vein quartz with streaky laminations, some of which is marked by red hæmatite. A fragment of grit adheres.

17. Quartz containing minute cubes of red hæmatite, probably pseudomorphs after pyrites.

18. Quartz with some mica.

19. Quartz pebble.

20. Quartz, probably vein quartz, with some mica.

[21, 22. Rocks from Scarcies river, two miles north of Sasseni, from two belts found in No. (11)].

21. A greyish quartz schist with even laminae occasionally marked by red hæmatite or by scattered glittering specks, probably of magnetite. This rock appears to have formed a pebble within the grit.

(Microscopic.) The slide consists of a mosaic of elongated grains, separated by a crystalline aggregate, doubtless the result of crushing. Neighbouring grains give uniform tint and the rock is evidently a pressure schist. Minute crystals, probably zircon, are imbedded. Thin and interrupted streaks occur, partly of magnetite, partly of a greenish mineral, which is filmy, dichroic, changing from pale apple green to myrtle green, apparently mica. Some of the magnetite is in small oblong bars, and the greenish mineral is often connected, as if the iron oxide was a product in its decomposition, although infiltration has almost certainly occurred in the rock. Since the pressure structure crosses the mineral streaks at a low angle, it is very difficult to understand why the later crystallisation followed other surfaces than those which we should expect to be the planes of weakness.

22. Pebble of compact strong reddish grit with small fragment of the gritty matrix adhering. A small pebble of green grit bleached at the exterior is also included.

## II. *Kofu Mountain.* Lat. cir. $9^{\circ} 20'$ .

[23, 24. Gneissose rocks composing the whole of the lower part of the mountain from 500 to 3,200 feet, extending to within 800 feet of the top. They weather in slippery rounded masses.]

23. A biotite gneiss, probably a modified granite, consists of white felspar, quartz, and thin streaks of black mica; very like (78). On a pale greenish slickensided surface are specks of pyrites.

24. A black and white gneissoid rock, weathering slightly brownish, and breaking into slabs along a well-marked foliation.

(Microscopic.) A hornblendic gneiss, most probably of igneous origin. The felspar is partially kaolinised, but well-formed, the quartz is in a rather coarse mosaic, and the hornblende exhibits



SIERRA LEONE  
(GEOLOGY).

characteristic cleavage and colouring. Biotite occurs, sometimes associated with the last-named mineral, and some epidote has formed. Sphene is abundant in minute and in larger crystals. A bright orange coloured staining is probably due to ferruginous alteration, and is characteristic of certain small crystals which apparently in some cases at least are forms of titanite. Some magnetite is present. Garnet occurs, and a mineral difficult to identify, possibly zoisite, and some small crystals are apparently zircon. The rock has been considerably crushed.

25. [Rock from lower slopes of Kofu.]

A fine grained dolerite consisting of felspar and brownish augite.

[26, 27. Quartz found in rock on lower slopes of Kofu.]

26. Quartz, probably from vein, contains small flakes of white mica, and is stained with brown iron oxide.

27. Granular quartz somewhat like quartzite, but probably vein.

[28, 29. Sandstones almost horizontally stratified, 800 feet thick, forming a capping of the table-like mountain plateau of Kofu.]

28. A laminated pebbly sandstone. The pebbles are of quartz, sub-rounded, about  $\frac{1}{2}$  inch long, imbedded in an arkose of quartz, felspar and mica. The layers are coloured bright red or brown, apparently by iron oxide.

29. A deep brown or black ferruginous quartz grit. The grains are mostly of clear white quartz from a minute size up to  $\frac{1}{4}$  inch across; and the cement is dark hæmatite.

### III. *Upper Scarcies Section, 500 to 2,000 feet.*

[30, 31. Rocks weathering in rounded oblong blocks, altitude 1,700 to 2,100 feet. Mount Jambi Buya-buya.]

30. A fine-grained dolerite, blackish, speckled with yellowish or resin-coloured crystals. One weathered surface is pitted with rather shallow depressions, reminding me of the weathering of part of the Penarfynydd mass (Carnarvonshire).

(Microscopic.) An ophitic dolerite with clear striped felspar, and augite, which is colourless except for a slight smoky tinge. At places much finer-grained aggregates of the same minerals interrupt the uniformity of the rock mass. Characteristic olivine occurs, and decomposition traceable in the usual way along cracks has resulted in a clear, brownish, probably ferruginous product spreading in some cases entirely over the crystal. Thus the original mineral was doubtless an olivine rich in iron. Crystals of magnetite are present.

The rock resembles (10).

31. A dark fine-grained dolerite, appears to be ophitic, and is very similar to (25), the crushed fragments consisting of felspar and augite.



32. [Rock found at an altitude between 500 and 1,500 feet above the sea; from Mount Jambi Buya-buya.] SIERRA LEONE  
(GEOLOGY).

A very compact dull green rock containing minute spots and specks of pyrites. The weathered surface is brown from oxidation of iron, and is finely pitted or scarius. The specimen is probably a compact altered basalt, although it bears some resemblance to a modified sedimentary rock; but it is evidently from near the edge of an igneous mass.

[33 to 37. Rocks exposed in Scarcies River at Wallia, *i.e.*, probably 400 feet above the sea. They have an irregular angular weathering easily seen from the specimens.]

33. A compact pale dull green and purplish rock with light-coloured veins of calcite. The specimen weathers to rough rhomboidal projections, and contains a few very minute rounded cavities like vesicles. It appears to be a compact diabase.

34. Three specimens which are also similar compact diabase, purplish, with green mottling and veins. Like some of the compact diabases of Wales.

35. Grey chert, weathering brown.

36. Pale brown, very felstone-like; probably, however, a compact indurated argillite.

37. A strong ironstone, consisting of quartz grains cemented by hæmatite. Possibly an iron "pan"; possibly a nodular mass formed as a local segregation.

[38, 39. Rocks composing a long ridge cir. 800 feet altitude, and ending at Wallia.]

38. A speckled, somewhat ophitic, fine-grained olivine dolerite, consisting of felspar, augite, and olivine. The felspars have a rather low extinction more often than we might expect in a basic rock of this character.

39. A compact blackish dolerite. Probably a similar rock to (38), but finer grained.

[40, 41, 42. Rocks weathering in rounded surfaces exposed in bed of Kora River at Wallia, altitude 900 feet. They usually form long ridges about 2 feet broad running across the stream.]

40. A grey to reddish brown ferruginous sandstone, the grains being angular to sub-rounded, consisting mainly of quartz and rotten felspar, coated with iron oxide; a few are of biotite. A fine lamination is faintly marked.

41. A similar, but slightly coarser, ferruginous grit.

42. A similar, but finer, pale brown sandstone.

42A. [A loose specimen.]

A blackish shale, soft and fine in grain. It might belong to some such series as the preceding, but it has no distinctive characters.



SIERRA LEONE  
(GEOLOGY).

IV. *Falaba Plateau, altitude from 2,000 to 3,500 feet.*

*Latitude 10°.*

43. [Hone stone found near Dunnia, altitude 1,000 feet, at Gonkwi mountain.]

This is a fine-grained dolerite, and not a compact sedimentary, as is more usual in the case of such stones.

44. [43 to 50. Rocks chiefly from blocks towards the base of Gonkwi Mountain, near Dunnia, Talla.]

A pale greenish, compact, flinty looking rock, having minute quartz grains very closely set, and small black deposit, probably of oxide of manganese.

(Microscope.) The grains are almost entirely of quartz, only a few being a pale green, slightly dichroic mineral, apparently epidote. The quartz is clear, but merges towards the boundary of the grain into a mass of short prisms of a colourless transparent mineral, probably epidote. This crystalline aggregate, doubtless, in part replaces the felspathic material of the ground mass; and the rock must have been originally a rather muddy quartz grit, now having something the character of an epidosite. Its half-flintoid nature is probably due to long continued alteration, and the grit is not likely to belong to a period later than Palæozoic.

[45, 46, 47, 48, 49, 50. Obtained near the base of Gonkwi Mountain, Dunnia, chiefly from fallen blocks.]

45. A shabby piece of quartz, apparently from a vein, somewhat iron-stained.

46. A fine grained grit of clear quartz and pink felspar, probably similar to (40), but a fresher specimen.

47. A fine-grained brownish quartz felspar grit.

48. A banded sedimentary rock, consisting of fine gritty silicified laminae and more muddy brown streaks. A slight current bedding is indicated.

[Microscopic.] The gritty layers consist of angular and sub-angular quartz and felspar, often plagioclase. A few flakes of mica or chlorite, and one rounded grain, apparently tourmaline, occur in the slide. These constituents are closely set within a fine grained partly felspathic aggregate. The muddy layers contain similar minerals in smaller fragments, but consist largely of ferruginous and other decomposition products. The rock belongs very probably to the series which includes (44).

49. A brown to reddish fine-grained quartz felspar grit containing crystals of whitish felspar grit, which retain a squarish outline, but are rotten, especially at the exterior. The grit includes apparently more than one form of felspar; well-marked plagioclase, orthoclase and microcline occur; also a greenish mineral, which appears to be a secondary product of a chloritic nature. The rock probably accumulated at no great distance from the mass whence its materials were derived.

50. A red impure jasper, doubtless vein stuff.



[51, 52, 53, 54. From fallen blocks on the way up Gonkwi Mountain, Dunnia, Talla country, Scarcies cir.  $9^{\circ} 40'$ .] SIERRA LEONE  
(GEOLOGY).

51. A fine-grained dolerite, consisting of clear white felspar and blackish augite.

52. A similar dolerite finer grained and containing whitish decomposed felspar

53. Similar, containing felspar, augite and black mica. The felspar has fairly large extinction angles, and is probably labradorite.

54. A compact dark basalt weathering to a bright brown ferruginous crust.

55. [Horizontally stratified rock from Bolowallia, forming a cliff 100 feet high.

A compact gritty greyish argillite finely laminated.

(Microscopic.) The more gritty bands contain angular to rounded grains of quartz and felspar. The ground mass includes a development of a small fibrous mineral, and in the more muddy layers, similiary secondary microliths form short, prismatic, closely-set aggregates, which appear brighter in polarised light like incipient crystals. The structure is suggestive of a very early stage of contact alteration, and the indurated character of the rock probably is due to this cause, although it could not be inferred as a necessary condition from the microscopic appearance.

56, 57. Cliff near Bolowallia. A lower band (56) and a higher band (57) in the horizontally stratified rock.

56. [A horizontal band about 9 inches thick in the above horizontally stratified rock from cliff near Bolowallia.]

A fine-grained quartzose grit with some felspar.

57. [A band 18 inches thick in (55).]

A grit consisting of clear transparent quartz and milk white felspar. Probably an arkose, although ver like a binary granite.

58. [From Bolowallia cliff.]

A banded sedimentary rock, including fine-grained quartz felspar grit and thin more muddy laminae; probably something like (48.)

59. [Granitoid rock from stream just below Sumbaraya, altitude about 2,400 feet; weathers in rounded lumpy masses.]

Fine-grained granite, consisting of transparent quartz, whitish, brown, or pinkish felspar, and greenish biotite.

60. [Rock from Mountain Gonkwi, near Duunia, Talla country. This specimen is from a cliff at the extreme summit of the hill, at an altitude about 3,000 feet. (See sketch.)]

A speckled rather fine-grained dolerite.

(Microscope.) A serpentised enstatite dolerite. Plagioclase felspar and somewhat smoky looking augite are arranged in an ophitic manner. Biotite and some magnetite occur, but the most marked constituent is a serpentised mineral. The crystals are fairly large, and appear to form as much as 50 per cent. of the



SIERRA LEONE  
(GEOLOGY).

rock mass. They are almost entirely pseudomorphosed, and in some the interior is a sheet of green serpentinous substance, in which the parallel enstatite cleavage can be traced, while the peripheral zone has been altered to a dull greyish substance, probably partly calcareous. This rock appears from the description to be part of the mass which caused contact alteration in the black argillite (61).

[61, 62, 63 Rocks, comprising a large part of Mountain Gonkwi, near Duunia, Talla. Some of these rocks are used by natives as hones and are said to be very good.]

61. A uniform very compact black rock, difficult to identify in the hand specimen, but having an appearance rather like a basalt. It weathers to a pale brown to the exterior and minute specks of pyrites occur. Traces of lamination have been almost completely obliterated, but can be recognised with difficulty.

(Microscopic.) By microscopic examination the rock proves to be a kind of baked argillite. Within a brownish matrix are a number of clear crystal-shaped spots having slightly darker centres. These are aggregates of minute granules, and are evidently due to contact alteration, an incipient formation of andalusite. The summit of the cliff just above is a mass of dolerite (60), which was probably the agent of metamorphism.

62. A very compact, fine-grained, dark rock, probably a basalt somewhat modified, with indications of spherulitic structures.

(Microscope.) The rock shows an interesting combination of ophitic and spherulitic structures. The ground mass consists of small augite and felspar with rectangular boundaries intergrown in the usual manner in a micro-ophitic rock, but the inter-crystallised minerals distinctly form long bars arranged in groups around central points and extending outwards in radial directions. Some enstatite and biotite occur as part of the matrix and some slightly larger crystals of enstatite partly serpentinised. The specimen is evidently a fine-grained variety of the mass from which (60) was obtained, this more compact and spherulitic form being probably from near the edge.

63. A dull grey, hard, argillaceous rock, with a very fine dark speckling, which was probably a result of slight contact alteration. It is similar in appearance, although slightly marked, to the structure which can be found at a distance from a granite intrusion. Such specimens from near the Avranches mass were kindly pointed out to me by Professor Bonney. I have seen something similar near small dolerite masses in Devonshire.

[64 to 69. Typical rocks from Sikuru at base of Wolla Mountain Plateau.]

64. [Coarse red syenite found in streams at base of plateau at Sikuru on the opposite side to Duunia; altitude cir. 1,000 feet. At the lowest level exposed.]

A coarse red granite or quartzose syenite, including clear colourless quartz, a small amount of biotite, some pale whitish felspar, and a large quantity of deep red orthoclase.



65. [Quartz found in (64). It occurred on a loose boulder and was a belt about 8 inches thick.] SIERRA LEONE  
(GEOLOGY).

A vein quartz.

[66, 67, 68, 69. Rocks composing practically the whole mountain occurring above the coarse red rock.]

66. A biotite gneiss or gneissose granite, rather fine grained, somewhat foliated, consisting of a colourless quartz and felspar and abundant black mica.

67. A fine-grained dolerite with whitish felspar not unlike (25).

68. A similar rock very slightly coarser and rather fresher in character.

69. Probably a segregation of quartz and felspar in the biotite gneiss (66.)

V.—*Kundita and Falaba, alt. cir. 3,500 feet, lat. 10°.*

[70, 71, 72. Rocks composing the Plateau Kundita and Cassa; altitude cir. 3,500 feet.]

70.—Gneissose rock or quartz, felspar and black mica, the biotite more richly developed along certain bands.

71.—A biotite granite or gneiss very rich in black mica. Some minute crystals appear to be red hæmatite after pyrites.

72.—A somewhat coarse-grained rock of the norite type, with rather small amount of a black constituent, and large quantity of a yellowish or greenish resinous-looking mineral associated with well formed felspar.

(Microscopic.) The rock includes some quartz. Much of the felspar shows close plagioclase stripings; in other crystals the twinned bands are broader and shade off more faintly. Biotite is well developed, and is sometimes inter-crystallised with a pyroxene. This occurs as an orthorhombic mineral which is very dichroic, changing from green to cherry red, and is evidently amblystegite. Other examples perhaps are nearer to a hypersthene somewhat altered.

As far as I know, this particular variety of holocrystalline rock has not received a name. Similar rocks occur in the Laurentian series of North America, perhaps rather in association with those usually designated Norian, but it is no doubt igneous.

73.—[Coarse red granite or syenite between Kundita and Kambe.]

A reddish granite of clear quartz and much red felspar, some being microcline, contains dull greenish patches which appear like segregations. These consist mainly of viridite, probably an altered hornblende with epidote.

74.—A pale brownish fine-grained granitoid rock, containing some black mica; also an orthorhombic pyroxene, and limonite replacing small scattered crystals which were probably originally



SIERRA LEONE  
(GEOLOGY).

of similar nature. The fragments obtained by crushing the pyroxenic constituent are dichroic changing from pale red to colourless, or very pale green, have rich polarisation colours, high refraction, and straight extinction, and the minerals seems to be amblystegite.

[75, 76. The minerals in these specimens is very common, often forms a glittering dust in the streams.]

75.—A specimen consisting of clear quartz, light coloured felspar and very abundant black mica, probably a biotite granite.

76.—A hornblendic gneiss or granite. Pale quartz and felspar with streaks of well crystallised hornblende.

[77, 78. Typical gneiss or schist forming numerous dome-shaped hills about Falaba.]

77. A white fine grained granitoid gneiss (like 78) with bands rich in well crystallised biotite.

78.—A whitish well crystallised gneiss containing black mica scattered along certain bands.

(Microscopic.) The felspar, much of which has plagioclase stripping, is inter-crystallised with the quartz as in a granite and well-formed biotite is associated.

The rock is a gneissoid biotite granite, rich in plagioclase.

[79, 80, 81, 82. From same locality, Falaba; not the typical rocks.]

79.—Biotite gneiss with reddish felspar.

80.—A similar specimen.

81.—Fine-grained mica diorite showing foliation, the biotite small and abundant with metallic lustre. Dull green, not very dichroic, microliths of hornblende are contained.

82.—A fine grained granitoid rock very possibly a band in gneiss. It consists of small quartz and reddish felspar with scattered specks of black mica.

[83, 84, 85, 86, 87, 88. From the same locality. The minerals are found in the above rocks.]

83.—Whitish granitoid rock containing some black mica.

84.—Quartz and pale pinkish felspar with some biotite; a veined specimen.

85-86.—Quartz doubtless from a vein, partly tinted like amethyst.

87.—Felspar apparently from a vein, with some quartz.

88.—Felspar with quartz, probably from a vein.

#### VI. *Return journey from Falaba to Bumban.*

89.—[Rock found at Bentembu on the way back from Falaba.]  
A much crushed rock, probably a mica schist which has been modified. The mica and the surface of the rock laminae are of a ruby colour tinted probably by iron oxide.

90.—[Quartz from same place.]

Quartz, probably from a vein with iron oxide.



[91 to 97. Chiefly from Bumban. Altitude cir. 1,000 feet.]

91.—A fine-grained mica diorite or syenite of whitish felspar, black mica and very little quartz.

92. A somewhat veined fragment probably from a micaceous gneiss.

93.—This appears to be an igneous rock belonging rather to the microgranite group, having at one part a slight streakiness, but whether due to crushing is difficult to say.

94. A mylonite, with fine laminae of quartz, of felspar, and of green hornblende.

95.—A fine-grained dolerite, very like (54) weathered to a thick brown crust.

96.—A similar specimen.

97.—A dark red and black rock very rich in an iron oxide.

(Microscopic.) A crystalline rock with granular structure, consisting of (1) a perfectly clear, bright, polarizing mineral looking like quartz, but very probably it is a replacement of felspar, and might even consist of topaz with which it agrees in some respects; I could not, however, obtain conclusive proof of its identity; (2) magnetite well crystallised; (3) a markedly dichroic mineral, changing from green to a reddish colour. We do not know how the dichroism may have been affected by the infiltration of iron oxide, but the mineral evidently has the appearance and characteristics of amblystegite. Some of the crystals are large but interrupted, enclosing grains of the clear quartz-like constituent. Hæmatite sometimes forms a thin film over the other minerals.

The rock appears to be igneous, originally some form of dolerite, in which much subsequent alteration has taken place.

### VII. *Iron ores and Deposits.*

[98, 99. Typical "laterite" from Sierra Leone.]

98-99.—Nodules of red and brown iron oxide, hæmatite or limonite, very probably formed as a kind of iron "pan" at the surface.

100.—[Form in which smelted ore is carried to be worked up by the natives.]

A piece of black ropy slag.

[Specimens of iron ore brought to be analysed.]

101. A very heavy, dark-reddish brown rock, consisting of blackish iron oxide, within which small narrow whitish prisms are imbedded.

(Microscopic.) The white crystals prove to be an aggregate substance like pinite, and the surrounding mineral is a compact metallic ilmenite or magnetite, together with hæmatite having the usual reddish colour along translucent edges. Two or three crystals occur in the slide, their cleavage planes marked by deposit of iron oxide, their substance pseudomorphosed, but the form retained. These appear to be a pyroxene in the first stage of alteration, the



SIERRA LEONE  
(GEOLOGY).

further result of which is the formation of the crystals of iron oxide, and in certain of these the cleavage planes are perhaps indicated by parallel lines.

This rock is apparently an altered dolerite, where the felspar has been replaced by pinite, and other constituents by iron oxide.

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